MAYURA

Vol. 12 1995

SPECIAL ISSUE

Proceedings of Decennial Seminar (1980-1990)

"The Role of Birds in the Environment & Their Conservation"

JOURNAL

OF

BIRDWATCHERS' SOCIETY OF ANDHRA PRADESH

BIRDWATCHERS' SOCIETY OF ANDHRA PRADESH

(Regd No. 1158 of 1983)

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13/2/1999

MAYURA

VOLUME 12, 1995

Date of Publication: 31-1-1999

Indexed
Papers
15/3/99

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FOR PRIVATE CIRCULATION ONLY
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Illustrations: Sachin Jaltare

Articles for *Mayura* should be sent to the Honorary Secretary, Birdwatchers' Society of Andhra Pradesh, P.O. Box # 45, Banjara Hills Post Office, Hyderabad 500034, India.

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Artist: Sachin Jaltare

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EDITORIAL

In 1990, the Birdwatchers' Society of Andhra Pradesh was ten years old. To commemorate the decennial year, a National Seminar on the "Role of birds in the environment and their conservation" was held on 7th and 8th February 1990 at Hyderabad.

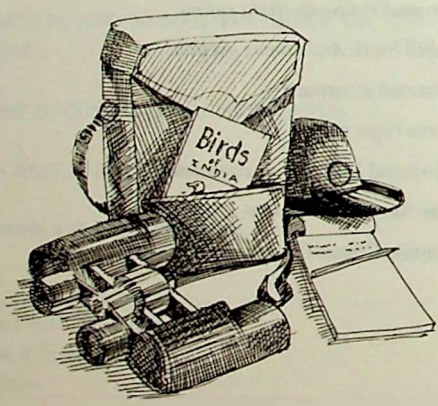
Faced with indiscriminate growth in population, pressure on land and haphazard industrialization which was resulting in widespread habitat destruction and affecting bird populations all over the country, it became necessary to focus attention on the resulting problems and find ways for conservation projects. Delegates from several states as well as Andhra Pradesh and Hyderabad representing various bird and nature organizations attended the Seminar. The several sessions spread over two days, covered four broad-based but important subjects.

Very interesting papers were presented and vigorous discussions took place after each presentation. At the end important proposals were made and the delegates adopted some resolutions.

The Proceedings are divided into four chapters, which are based on the topics of the papers in the Seminar. Economic Ornithology, Ornithology of Andhra Pradesh, Conservation Perspectives, and Development and Conservation. The final chapter consists of the Resolutions passed.

A lot of time has passed since the Seminar was held, but the subject matter is still relevant and the Resolutions worth implementing. Moreover, the Society was under an obligation to publish the Proceedings as it had received a generous grant in 1990 towards this from the Bombay Natural History Society.

Siraj A. Taher



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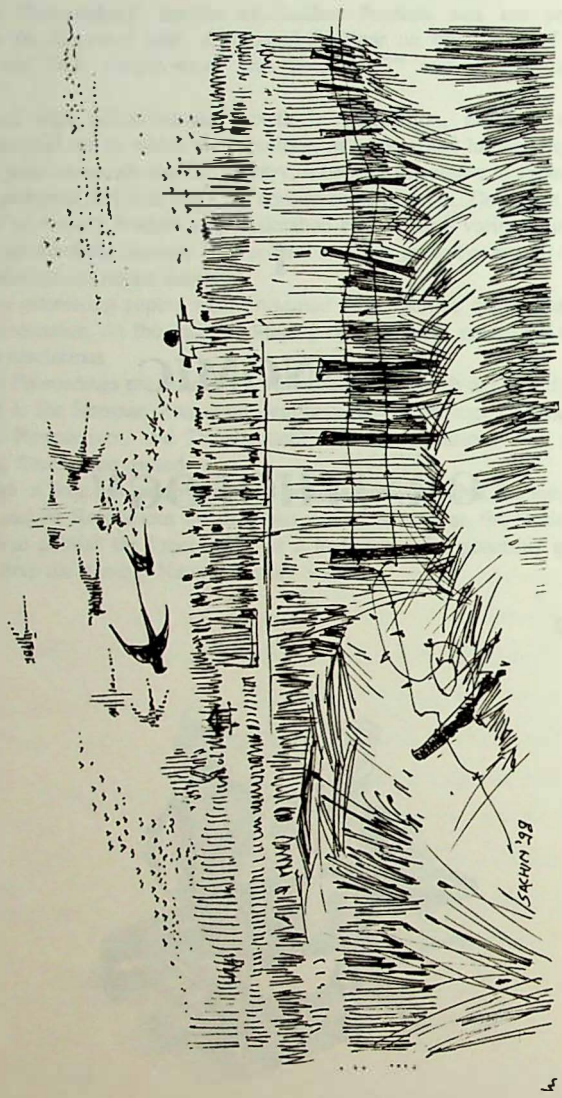

THE ROLE OF BIRDS IN AGRICULTURE ECOSYSTEM

P. SYAMSUNDER RAO, K. SESHACHALAM BABU
& N. SANTHAIAH

ABSTRACT

Indian avifauna is represented by 2060 species out of the total world population. Prominent among them are ten species which degrade crops and only a few of them form serious bird pests. Based on the feeding habits, the birds are classified as granivorous, frugivorous, insectivorous, carnivorous and omnivorous. The degradation to crops by the granivores and frugivores is a consequence of t heir flock feeding habits and most of the major pest species have a well developed foraging behaviour, while some species have a dual role in agriculture and their economic status needs further investigation. Although the birds form an integral part of agriculture ecosystem, their status in agriculture requires thorough examination of various factors like food, feeding habits, population and extent of loss they cause to agriculture and horticulture crops. An insight into the details of bird activity sufficiently elucidates the significance of their various roles in various situations. Bird pest management has been one of the difficult areas to tackle due to their high intelligence, adaptable and mobile nature, and above all the need to preserve the ecological balance.

INTRODUCTION

Birds form an important group of vertebrates not only they are most beautiful and colourful or they are melodious singers but because they have a significant role to play in our agriculture and horticulture and also form an integral part of agricultural ecosystem. In India there are about 2,060 species of birds representing 20 Orders of them only about 10 Species depredate the crops and only a few of them have so far become serious pests of crops. Birds long have been classified according to their feeding habits as granivorous, frugivorous, insectivorous, carnivorous and omnivorous.

BIRDS AS DEPRECATORS

Among the various granivorous bird species in the world many are specialized for a diet of grass seed and only a small number have so far become serious pests of crops. The depredation to crops by the granivorous and frugivorous is

a consequent of their flock feeding habits and most of the major pest specie shave a well developed forage behavior. In India the most common bird pests of crops are Roseringed Parakeet *Psittacula krameri*, Baya *Ploceus philippinus*, Blackheaded Munia *Lonchura malacca*, Spotted Munia *Lonchura punctulata*, Blue Rock Pigeon *Columba livia* and House Sparrow *Passer domesticus*. Besides these, birds like Indian Myna *Acridotheres tristis*, Rosy Pastor *Sturnus pagodarum* and Redvented Bulbul *Pycnonotus cafer* may also, at times, turn into crop depredation in the grain ripening stage. Usually the damage is concentrated in the isolated areas surrounded by human dwellings. Damage to crops may be caused by one or more species of birds but the severity of loss is magnified when they are in large numbers. The percentage of damage depends upon various factors like population, local conditions of the crop and availability of the food. For thorough assessment of damage a scientific study on the extent of damage, nature of damage, susceptibility stage of the crop, period of damage has to be conducted for correct understanding of the problem.

Studies conducted in Andhra Pradesh Agricultural University, Hyderabad, revealed that in Maruteru (West Godavari district), a rice belt area, the crop suffered damage ranging from 2.27% to 23.60% at harvest stage. Short duration varieties like *Tella hamsa* are more vulnerable to bird attack. Roseringed parakeets, bayas and munias are major bird pests of rice. (Ali, *et. al.* 1976; Sitaramaraju, *et. al.* 1982, 1984). In sorghum the earheads suffer a loss of 7.92% to 44.62% in different varieties. But in the awned varieties the damage was very much negligible. (Santhaiah, *et. al.* 1983; Santhaiah, 1986).

In sunflower the damage is considered to be the maximum by a single bird species of Roseringed Parakeet and the damage ranged from 60-80% some times even 100% also if scaring is not done at the time of grain formation stage (Ali, *et. al.*, 1976; Besser 1976). In maize like paddy, is not subject to heavy bird attack where only 15% loss occurs at cob stage but when the crop is raised in small areas (Ali, *et. al.* 1982). Besides there are other pulse crops like black gram, green gram also been damaged by the birds (Shivnarayan & Sitaramaraju 1981). In wheat the damage commences from the sowing stage, continues till the seedling stage, and is done mostly by sparrows, pigeons, and partridges. In some areas the damage also caused by migrants like starlings (Bhatnagar & Raizada 1975). At ripening stage sparrows and parakeets, weaverbirds damage the ear heads. Cotton is another crop, which suffer 5% seed loss at sowing stage by Peafowl *Pavo cristatus*. Fruit crops like mangoes, figs, jamun, grapes, pomegranates, *ber* are heavily damaged by birds like parakeet, munia, bulbul. In most cases the parakeets are the most destructive bird pests and have very wasteful in their feeding habits (Ali 1977).

BENEFICIAL ROLE OF BIRDS

Some birds are recognized as friends of farmers as they feed on insects of economic importance (Ali 1977). The birds included in this category are Black Drongo *Dicrurus adsimilis* (now *D. macrocercus*), Indian Roller *Coracias benghalensis*, Swallows *Hirundo* sp., Indian Myna, Bank Myna *Acridotheres ginginianus*, Rosy Pastor, Cattle Egret *Bubulcus ibis*, Baya, House Sparrow, Bee-eaters *Merops* sp., Golden Oriole *Oriolus oriolus*, Pipits *Anthus* sp., Leaf Warblers *Phylloscopus* sp., Pied Wagtail *Motacilla maderaspatensis*, Tailor Bird *Orthotomus sutorius*, Ashy Wren Warbler *Prinia socialis*, Magpie-Robin *Copsychus saularis*, Hoopoe *Upupa epops*, Spotted Owl *Athene brama*, Common Nightjar *Caprimulgus asiaticus*. These insectivorous birds did commendable job in controlling BollWorm *Heliothis armigera* population n summer groundnut crop at Anand (Gujarat) (Anon. 1988). Losses of stored grains due to birds occur but no definite estimates are available. Especially in villages and also in urban areas, pigeons, sparrows, munias, doves are the frequent visitors to storage sites where much of their feeding is on spilled grass and often roost over grass and contaminate the stores.

Keeping in view of the importance of agriculture and to develop a scientific method in economic ornithology which would ultimately reach bird pest management programmes. These programmes are highly complex then employed for insect pests due to their high intelligence, mobility, adaptability because of the dual role played by some of the insectivorous birds in our agricultural ecosystem. There is need to maintain the natural ecological balance, a safe and economical strategy has to be thought of in avian pest management programmes. Various traditional methods like human scaring, pelting of stones, using of crackers, netting, use of carbide guns, beating the empty tins, are in practice in India. Chemical repellants like methiocarb, mesural, thirum, curb (Aluminium ammonium sulphate) have been tried in U.S.A., Canada and their repelling effect was successful (Bruggers 1975, 1979, 1981). In India Neem cake solution has shown to reduce the level of damage in maize from birds to some extent (Shivnarayan & Rao 1988). Experiments conducted with the bio-acoustic methods like use of distress calls on the maize crop to ward off the bird pests like roseringed parakeets and crows given satisfactory results (Rao & Jayawardhan 1987).

Of all the devices tested the reflective tape known as BIRD SCARING REFLECTIVE TAPE is found to repel the bird pests from crops. The reflective tape is prepared from metallic paper of red and white colour commonly available in the market. The paper is cut into tapes of about 30 feet length and 10-12 mm width. Each tape is fixed in the field after earhead emergence and grain formation time just above the crop level. About 20-30

tapes can be used for a hectare area. The tape reflects sunlight to produce a flashing effect nd stretched and twisted, it produced a humming noise in the wind and the birds on seeing the reflection from the tape move away from the cropped area. This method is safe, economical and effective especially for sunflower, maize crops. Studies conducted in the All India Coordinated Research Project on Economic Ornithology, A.P.A.U. on sunflower crop in the experimental and in the cultivators field gave promising results in terms of yield (Rao & Shivanarayan 1988).

Evaluating the agricultural damage is much difficult while losses to depredating birds are real, especially to the victimized farmers, a satisfactory method of determining damages, seldom have been available in the past. It is apparent that a more systematic and integrated approach is needed to achieve the satisfactory results.

ACKNOWLEDGEMENTS

The authors thank the Indian Council of Agricultural Research, New Delhi, for the sanctioning of the centre at A.P.A.U. Rajendranagar under which the present studies were conducted. The authors express their sincere thanks to Dr N. Shivanarayan, Project Coordinator, A.I.C.R.P. on Economic Ornithology, for his valuable guidance and help in carrying out the work.

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TABLE 2

Number of Crows feeding on 'Bajra' *P. typhoides* during its sowing and sprouting stage in 1988

Species	Stage	Total No. of birds observed in the field	No. of birds found feeding on the crop	No. of birds found feeding on other food material
Corvus splendens	Sowing	430	-	371
C. macrorhynchos	Sowing	179	-	132
C. splendens	Sprouting	328	-	296
C. macrorhynchos	Sprouting	122	-	097
C. splendens	Sapling & flowering	489	-	360
C. macrorhynchos	Sapling & flowering	212	-	173

RESULTS AND DISCUSSION

As given in Table 1, the damage by crows in the 'bajra' field is less while the crop is standing in the field. After the crop is harvested more number of crows come to feed on the grains. During the study period while 87% of House Crows were found feeding in the harvested crops only 45% of Jungle Crows were recorded doing so. However, the relative abundance of two crow species is also different in the study area. It has been discussed somewhere else that due to certain ecological factors the number of House Crows were much larger in the study areas. It is interesting to note here that while 20 nests of House Crows have been recorded in the study area, so far we have not recorded any nest of Jungle Crow in the same limits.

As shown in Table 2, no crow was found feeding on the 'bajra' in sowing, sprouting, sapling and flowering stages but nevertheless they were always present in the study area either feeding on some cow dung, fecal matter or picking up insects. Comments on animals' food material of the crows has been discussed somewhere else.

The use of scaring tapes was found very effective. The birds were found avoiding the sample plots where the tapes were used. Studies by Mathew (1988-89), Yahya & Raheem (1989) and Yahya & Javed (1989), also suggest that the use of scaring tapes could be very effective for scaring the birds from agricultural and horticultural fields. The only problem is that the good quality tapes are considerably expensive. However if the Government subsidizes the manufacturing, it can be available in manageable price. Since the farmers

already use the alternate scaring devices such as drum beat, etc., the birds will not get 'used to' by the tapes if its installations are planned properly and the experiments are shifted periodically from plot to plot.

ACKNOWLEDGEMENTS

This paper is a part of a project sponsored by DST (New Delhi). We are also grateful to the Centre of Wildlife and Ornithology, Aligarh Muslim University, Aligarh, for various facilities during the study.

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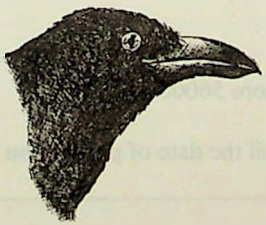

FOOD OF INDIAN BIRDS AND ITS IMPLICATION IN THE PENINSULAR AGRO-ECOSYSTEM

KUMAR GHORPADÉ

ABSTRACT[1]

An attempt is made to assess the impact of birds on agriculture, horticulture and plantations, based on the food and habitat preferences of some 60 families of birds in India. It is emphasized that except for local situations allied with abnormally high populations of seed-eaters and grazers, birds do not present pest problems of concern in most agro-ecosystems in peninsular India. Similarly, the oft-repeated claim that birds are "important" predators of the insect fauna is questioned. Since less that 1% of insect diversity is known to compete with man for earthly resources and since birds (unlike insect predators, parasitoids and competitors) are not specific in their food habits, it is suggested that birds, generally, are not such an important component of the ecosystem as we are made to believe. However, as the agro-ecosystem is now the single largest habitat for birds, some recommendations are made for encouraging insectivorous and raptor bird populations on the farm and the plantation. The role of birds as efficient pollinators is also minimal.

In conclusion, it is highlighted that protection of vegetation (especially still undisturbed ecosystems) and through that of the insects, both of which form the largest biomass on earth, is critical for man's survival. His unjustified concern for the "conservation" of larger animals (including birds) at the expense of plant and insect diversity may have been instrumental for the "upside down" strategies related to his environment employed so far. Unless man substitutes a policy of augmentation (rather that "conservation" of the ecosystem (not just his environment), the greenhouse effect and related climatic deterioration and increased competition from insect immigrants into his agro-ecosystem can only land him into irreversible disaster as a living biological animal dependent on Nature's "Laws".

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[1] Editor's Note: Full paper was not received till the date of publication.

II

ORNITHOLOGY

OF

ANDHRA

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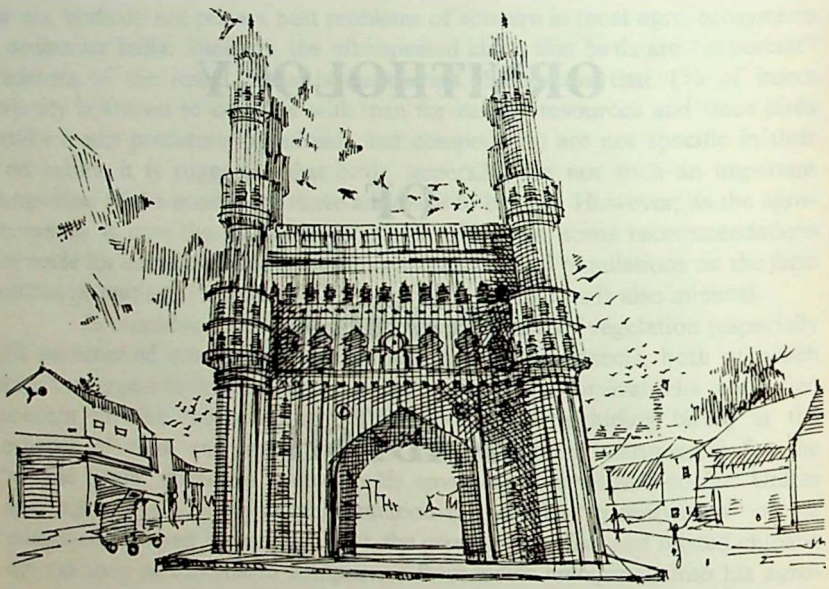

HISTORY OF ORNITHOLOGICAL STUDIES IN ANDHRA PRADESH — A BRIEF REVIEW

SIRAJ A. TAHER

ABSTRACT

Andhra Pradesh is one of the leading agricultural states of India and since birds have importance in relation to agriculture, there is a need to undertake serious ornithological studies of the region. Ornithologically, Andhra Pradesh is one of the least known regions in India. The distribution and status of even the most common birds is improperly known. Only two major bird surveys were undertaken in some regions of the State. One, the Vernay Scientific Survey of the Eastern Ghats. (Whistler & Kinnear 1930-37) and the Hyderabad State Ornithological Survey (Ali 1931-32). Other than these, only a few sporadic works have been undertaken from time to time and these were confined mainly to the Eastern Ghats in the northeast and northern parts of the State.

In recent years, most of the works have really been studies of individual species, their ecology, status and distribution. Most of the information and data on the distribution and status of other species has only been an incidental outcome of such works.

The inter-dependence between avifauna and flora has been little studied in this country. The formation and functioning of bird societies, wildlife and nature clubs in different parts of Andhra Pradesh is likely to significantly add to the knowledge of the distribution, status and ecology of the fauna, avifauna and flora of Andhra Pradesh. This will in turn create an information base that will facilitate further studies and better environmental evaluation.

One of the earliest works on the birds of the erstwhile Madras Presidency, some regions of which now from part of Andhra Pradesh, was by T.C. Jerdon in 1839-40. It was reported in the *Madras Journal of Literature and Science*, volumes XI and XII as "Catalogue of birds of the Peninsula of India" and a supplementary list was published in Volume XIII (1844) of the same *Journal*. While most of Jerdon's work was around the Nilgiris, there were some specimens that he collected around the Eastern Ghats, the greater part of which was on the East Coast of India. About 30 years later, V. Ball reported on his work done in Kondakarla, Rajam and surroundings (Vizagapatnam Dist.) in an article in *Stray Feathers*, Vol. 5 (1877). The specimens collected by Jerdon and Ball are in the British Museum of Natural History.

One of the most extensive ornithological works undertaken in the state (parts of which are now in Tamil Nadu) was the "Vernay Scientific Survey of the Eastern Ghats" under the aegis of the Bombay Natural History Society (BNHS). This survey, started in 1929, was unique in more ways than one.

1. It was wholly funded by a single individual (A S. Vernay) through the BNHS.
2. It was the first thorough and scientific bird survey undertaken in the region.
3. V.S. LaPersonne collected all the birds on site all over the Eastern Ghats, prepared specimens and sent them (by ship) to Hugh Whistler in England

It was in England the fully documented report of this Bird Survey. The collection work had started in April 1929 by LaPersonne in Salem district (now in Tamil Nadu) and ended on 28th February 1930 at Visakhapatnam (then called Vizag) in Andhra Pradesh (AP). The areas, now in AP, from which bird specimens were collected, are south Cuddapah district (July-Aug 1929) south Kurnool district (Oct-Dec 1929), Godavari district (Jan 1930) and Vizagapatnam district (Feb 1930). A total of about 1,550 specimens were collected by this Survey, of which about two-thirds of them (*c.* 1,000) were from areas which are now in AP. The complete Vernay Scientific Survey of the Eastern Ghats—Ornithological Section, was subsequently published in the *Journal of Bombay Natural History Society* (JBNHS), vols 34-39 (16 parts). In the notes to this survey, Hugh Whistler (HW) wrote, "the birds of India are well known and probably a few or no species remain unknown. A few geographical races perhaps remain to be discovered and a great deal of work remains to be done to study the distribution of many known species."

Elsewhere he wrote, "ornithologically, Madras Presidency is the least known part of India." Well, even today, this is true of Andhra Pradesh.

About this time (1930), H.R. Baker and C.M. Inglis compiled a book *Birds of Southern India*, from the two *Faunas* then available — *Fauna of British India - Birds* (Blanford & Oates 1889-98) and *Fauna of British India Birds* (Baker 1922-30). This book has about 511 species with a few additions and corrections made after the Eastern Ghats Survey (Whistler & Kinnear 1929-30) was published.

The second most important and comprehensive bird survey of Andhra Pradesh was the one undertaken by Sálim Ali and known as the "Hyderabad State Ornithological Survey" (1931-32) in the erstwhile Hyderabad State, a major portion of which now forms a part of Andhra Pradesh. This survey was financed by the then Hyderabad State Government. Even though fair-

extensive, quite a few regions were not covered. A lot of areas were not surveyed as Sálim Ali hoped to go there later, but for various reasons, it could not be re-started.

Since it was the first ever scientifically conducted work in this area, many new species were discovered for the region. 262 species were collected or noted from areas now in AP with an additional 17 species collected from Warangal along with R. Meinertzhagen in 1937. Sálim Ali received great help from Col. R. Sparrow who had a good personal collection of bird specimens from in and around Trimulgherry / Bolarum / Alwal and Eswantraopet, which areas now form part of suburban Hyderabad city. Sparrow's collection made from 1910-1913 is now in the British Museum of Natural History. An extremely meticulous collector, Sparrow also had specimens from some other areas, which are now in AP. He also collected eggs and kept notes on the nesting season. The Hyderabad Survey also recorded the natural vegetation of the area, agriculture and the economic status importance or relevance of the birds vis-à-vis the local population.

Subsequently, Abdulali (1945) surveyed areas in Ananthagiri, Sankarmetta and Lamasinghi during May 1944 and brought out a fairly comprehensive list "Birds of Vizagapatnam District" with nearly 277 species recorded in the region. He did more work later in the same places and an additional list was brought out in 1953. These works added considerably to the avian records of the region.

Besides these works in Andhra Pradesh, there have been some others who have done serious collection work and studies of birds in the State. Most of these have been fragmentary studies in different regions, mostly confined to the northeastern parts of the Eastern Ghats, in and around Visakhapatnam district. Trevor Price (1976-77, 1979, 1983), Krishna Raju (1971, 1973, 1978, 1985), Hussain (1976), Ripley, Beehler, Krishna Raju & BNHS (1984), Grubh (1976) in Sriharikota, (Nellore district) and Majumdar (1984) in Adilabad district. The other areas of bird studies have been those taken up by BNHS. The Great Indian Bustard *Ardeotis nigriceps* in Rollapadu from 1985, continued for several years. Incidentally, the Lesser Florican *Sypheotides indica* was also a subject of study here and at Medak. The re-discovery of the Jerdon's Courser *Rhinoptilos bitorquatus* near Vontimitta (Cuddapah district) in 1984 led to some work in the region. Only 5 birds have been sighted so far.

All the surveys in the Vizag Ghat region—Vernay, Abdulali, Price, Krishna Raju, Ripley and BNHS—show that 216 species of birds are found here. Some interesting species being the Chestnutbellied Nuthatch *Sitta castanea*, Little Spiderhunter *Arachnothera longirostris*, Brook's Flycatcher *Muscicapa poliogenys* and the Great Crested Grebe *Podiceps cristatus*.

The field trips, visits to water-bodies and camps of the Birdwatchers' Society of Andhra Pradesh and it's members, has added considerably to the knowledge of the distribution pattern and status, especially in and around Hyderabad and also the surrounding districts of Medak, Rangareddi, Warangal, Nizamabad, Nalgonda and Mahbubnagar. The census work undertaken since 1987 for the Asian Waterfowl Count has also further added to the data available. *A Checklist of Birds of Andhra Pradesh*, compiled by Taher and Pittie (1989) shows nearly 500 species and races as found and recorded in Andhra Pradesh.

A lot more needs to be done to try and understand the distribution, status and population dynamics of birds in the state especially in the face of disappearing wetlands, depletion of forests and rapid urbanization. Those who worked in the earlier years were pioneers. It is for us to take their effort forward from here.

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STUDIES ON THE WATERFOWL OF MANJIRA WILDLIFE SANCTUARY, MEDAK DISTRICT, ANDHRA PRADESH

V. VIJAY KUMAR & B.C. CHOUDHURY

INTRODUCTION

Manjira Wildlife Sanctuary in Medak District located 50 kms northwest of Hyderabad in Andhra Pradesh, has been recognized as an important wetland for migratory birds. The Directory of Asian Wetland (1984) published by IUCN and WWF classifies Manjira into wetland type 17 (Water storage reservoir, dams). The Manjira Reservoir formed by construction of a barrage across Manjira River at Kalabgur, spreads over 2,000ha. The lake supports a varied shoreline with a thin margin of *Typha*, *Ipomea* and *Acacia*, fringing the water. Agricultural land, chiefly with paddy, maize, sugarcane, jowar and groundnut, constitutes the next line of vegetation towards the land. The reservoir's water spread also supports several islands with extensive marshy fringes together with the diverse aquatic vegetation of the lake. Thus, the water body provides considerable ecological diversity to support a large population of wetland birds. Together with Nizam Sagar and Pocharam further down the Manjira this area constitutes an inland wetland system in the Deccan part of Andhra Pradesh.

Following the declaration of Manjira Wildlife Sanctuary with the primary objective of protection and management of the Mugger Crocodile *Crocodylus palustris*, the State Forest Department has made an inventory of other aquatic fauna including wetland birds. The Birdwatchers' Society of Andhra Pradesh, during their field trips to this sanctuary in the winter have recorded 51 species of wetland birds during the early 1980s (Choudhury & Pittie 1983; Mathew 1984). The Asian Waterfowl Census in January 1987 recorded 46 species on the lower reservoir limits of the Sanctuary.

The Wildlife Institute of India initiated a Research Project in Manjira Wildlife Sanctuary in January 1987 with the objective of monitoring resident and introduced crocodile populations. As part of this research project all aquatic species were monitored. From Jan. 1987 to Dec. 1989 (a period of three full years) all waterbirds (also other birds) have been recorded. Though systematic census techniques have not been adopted during all field trips, total counts of birds observed have been made, which forms the basis of population counts.

During this period 70 species of waterfowl have been recorded in Manjira. This paper reviews the changes that have taken place in Manjira Wildlife Sanctuary with respect to waterfowl species composition, population structure, utilization of various aquatic habitats by wintering waterfowl with notes on the arrival and departure dates of important migratory species.

An attempt has also been made to identify limiting factors within the sanctuary limits that may effect the bird population. Biotic disturbance factors were also monitored with the objective of providing information to the wildlife management authority for better management of this important inland wetland area in the dry Deccan belt of Andhra Pradesh.

STUDY AREA

The 28-km long, 2,000 ha water-body of the Manjira Wildlife Sanctuary, (17°38'N, 78°05'E) is totally monsoon dependent, in the dry tropical monsoon climate that receives the south-west monsoon from June to September. The annual rainfall is around 915 mm. Summer temperature rises upto 42°C with the winter minimum of 15°C. Since the water-body provides the drinking water requirements of the twin cites of Hyderabad and Secunderabad, the water level fluctuates considerably during the dry season thereby altering the biological features of the lake. With maximum water depth of 16m., the average depth of the water spread ranges from 7.5m to 10m. The finger-like projections of the reservoir water spread and the island chains support rich aquatic submergent and emergent vegetation. Also important in the water body are *Typha* reeds and *Ipomea* fringes. Since the river does not flow through a forested area but in the dry undulated Savannah type land mass, the predominantly observed vegetation is *Acacia*, *Azadirachta*, *Annona* and *Prosopis*. The land-use pattern in the area is mostly dry land cultivation. Along the riverbank however, with the availability of lift irrigation system, one finds paddy, sugarcane, maize and other water-dependent cultivable species. Also cash crops such as chilly, groundnut, onions, *etc.*, are dotted along the riverbank of Manjira Wildlife Sanctuary. Grazing by domestic livestock, particularly sheep, does not have a major role to play on the vegetation of the area. During the dry season, other than the trickles of water of the down stream riverbed, the only source of water is the reservoir water spread. Naturally, there is considerable competition amongst human, domestic livestock and other wild fauna within the study area. The whole scenario changes once the monsoon sets in. Water, even in this dry area, becomes abundant, at least from July to October-November, and wild fauna is well spread—particularly the waterfowl.

METHODOLOGY

Though we do not claim to have adopted an elaborate and fool-proof census technique for waterfowl in the study area (in conformity with our basic objectives remaining elsewhere), the methodology used by us for making checklist of waterfowl, counting them and studying their habitat utilization pattern was based on fairly regular field trips. The method used was to scan the water body and the fringing vegetation on the shore line from a slow moving powered motor boat from the mid river using a 8x40 prismatic binocular. Irrespective of their location and number, all sightings were recorded and total counts were made. The maximum number sighted during weekly visits, during a month, were taken into account for population counts.

Since field visits were made almost every week (except perhaps during the monsoons) any new sighting or non-sighting gave us the details of arrival and departure of migratory species as also the status of resident birds.

For habitat utilization studies the water-body was mapped by using the standard technique of transect sampling from mid river to the shoreline at every 500m interval. Using such technique the total water-spread of the reservoir was mapped, illustrating the aquatic vegetation versus clear water within the water-spread (Fig 2). The aquatic areas thus have been classified into four habitat types:

Habitat 1	Riverbank tree cover, bushes and terrestrial grassland including cultivation up to 500m on the shoreline. (This area also includes mid-river islands.)
Habitat 2	Over-hanging shoreline vegetation with thick emergent vegetation.
Habitat 3	Sparsely emergent and totally submerged aquatic vegetation.
Habitat 4	Open water with occasional flotsam.

RESULTS

Species Diversity

The field study from January 1987 to December 1989 resulted in recording a total of 70 species of wetland birds that belong to 18 Families and 47 Genera (Table 1). During the first migratory season up to April 1987, a total of 69 species were recorded in the study area.

During the second season, starting from October 1987 to April 1988, a total of 65 species were recorded. The four species not recorded during this period were Flamingoes *Phoenicurus ruber*, Common Teal *Anas crecca*,

Ferruginous Duck *Aythya nyroca* and Bronzewinged Jacana *Metopidius indicus*.

During the third season from October 1988 to April 1989 a total of 55 species were recorded. Bronzewinged Jacanas appeared in the study area. The 15 species that were absent were Whitenecked Stork *Ciconia episcopus*, Spoonbill *Platalea leucorodia*, Flamingo, Barheaded Goose *Anser indicus*, Pintail *Anas acuta*, Common Teal, Common Pochard *Aythya ferina*, Redcrested Pochard *Netta rufina*, Tufted Pochard *Aythya fuligula*, Ferruginous Duck, Gadwall *Anas strepera*, Wigeon *Anas penelope*, Moorhen *Gallinula chloropus*, Redshank *Tringa totanus* and Wood Sandpiper *Tringa ochropus*.

Population Figures

Taking into account the peak sighting of a particular species during weekly visits, the maximum population of any species was counted. Thus, during say, the second week of February, the population of White Ibis *Threskiornis melanocephalus* in the study area was at a maximum. So the total population of White Ibis for that year was considered to be that particular peak number. Adding up the peak numbers of each species, the total population of waterfowl that have used the sanctuary limits were calculated (Table 2). During the first season a total in excess of 14,000 waterfowl were estimated to have used the study area. The number shows a declining trend for the next two seasons with estimates in excess of 13,900 and 5,400.

Habitat Utilization

On examining the sightings of different species of birds and their activities in each habitat, it is seen that Habitat 1, on the river bank, meets the nesting requirements of 13 species, feeding requirements of 15 species, and roosting requirements of 48 species (Table 3).

Habitat 2, which is partly aquatic and partly terrestrial, with overhanging vegetation and emergent vegetation, meets the feeding requirement of 55 species and nesting requirement of 2 species. Habitat 3, with mostly submergent vegetation, meets the feeding requirement of 28 species. The last habitat (Habitat 4), of open water meets, the feeding requirement of 21 species, most of which are carnivores.

Migratory Season

The migratory season began in the first week of December during the second season, with the arrival of Spotbill Duck *Anas poecilorhyncha* and Openbilled Storks. The last migrant to be still seen was Spotbill Ducks in August 1988. While the last to leave the study area in the previous year were Openbilled

Storks and Spotbill Ducks during July second week (Table 4). The migratory season in 1988 started with the arrival of teals, Coots *Fulica atra*, and Brahminy Ducks *Tadorna ferruginea* in October first week and ended with the departure of teals in the third week of June.

Thus, the migratory season in the study area stretches from October to June with peaks during December to February.

Breeding Records

Fourteen species of locally-migrant/resident waterfowl breed in the study area Painted Stork, Coots and Night Herons *Nycticorax nycticorax* are the most significant breeders in the study area. March, April, May and July seems to be the important time for breeding by the wetland birds in the study area. Juveniles of Openbilled Storks have been recorded in the study area, but it is not confirmed whether they breed here. The mid-river islands with the *Acacia* stands provide the most ideal and disturbance-free nesting habitat for waterfowl (Table 5).

Acacia followed by *Prosopis* and Tamarind *Tamarindus indus* constitute the major tree species used by breeding birds. *Ipomea* and *Typha* reeds form the next most important nesting vegetation. (Table 6).

Biotic Interference

The local land-use pattern and lifestyle makes it obligatory for some form of biotic interference on the habitat by the local inhabitants. Foremost being cutting of reeds for thatching, cutting of *Acacia*, Neem *Azadirachta indica* and *Prosopis*, along the riverbank, for fuel-wood, and sustainable level of fishing in the reservoir. Since the area has been declared a Wildlife Sanctuary, and protection and management are in action, such biotic interference are minimal and perhaps cannot be removed altogether till the local lifestyle changes and alternatives are provided to the dependent human populations.

DISCUSSION

Seventy species of wetland birds use the Manjira Wildlife Sanctuary making this an area important inland wetland of Andhra Pradesh. The decline of species from 70 to 55 and also the decline in their population need an explanation. The 1988-89 season was the wettest in the entire study period. It is felt that with availability of water all-around not many migratory birds visited the study area.

Also, on the northwestern boundary of the study area a larger water-body has been formed by damming the Manjira at Singoor. During the 1988-89 migratory season a waterfowl count was also done in this adjoining new area. A

maximum of 21,976 individuals, belonging to 28 species, has been recorded in this area (Vijaya Kumar & Choudhury 1989). Some of the species such as Redcrested Pochard, Barheaded Goose, *etc*., not recorded in the study area during the 1988-89 season, were recorded in very large numbers in the Singoor reservoir.

The authors feel that the main water-body of the Singoor reservoir on the northwestern boundary of Manjira Wildlife Sanctuary may also be included into a greater Manjira-Singoor Waterfowl Sanctuary. Incidentally a larger population of freshwater Mugger Crocodile (Kumar & Choudhury, unpublished), have also been recorded in the Singoor Reservoir.

The shoreline vegetation on the waters' edge, both terrestrial over hanging and submergent in Habitat 1 and 2 appears to be of significant value to the migratory wetland birds in the study area in terms of providing roosting, feeding and breeding habitat. The present level of biotic interference and use may not be compatible in the future years unless a strict check and restrictions are in force.

Till recently the management strategy for the Manjira Wildlife Sanctuary had crocodilians as the key species. It appears now the emphasis of management of this area may have to shift from Crocodilians to wetland birds thereby extending the management zone further away from the aquatic area limits to the shoreline terrestrial areas that are vital for wetland birds.

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TABLE I

WETLAND BIRDS RECORDED IN MANJIRA WILDLIFE SANCTUARY

SPECIES	Jan-Jul 1987	Oct-Aug 1987-88	Oct-Aug 1988-89
LITTLE GREBE *Podiceps ruficollis*	x	x	x
CORMORANT *Phalacrocorax carbo*	x	x	x
LITTLE CORMORANT *P. niger*	x	x	x
INDIAN SHAG *P. fuscicollis*	x	x	x
DARTER *Anhinga rufa*	x	x	x
GREY HERON *Ardea cinerea*	x	x	x
PURPLE HERON *A. purpurea*	x	x	x
LITTLE GREEN HERON *A. striatus*	x	x	x
POND HERON *A. grayii*	x	x	x
CATTLE EGRET *Bubulcus ibis*	x	x	x
LARGE EGRET *Ardea alba*	x	x	x
MEDIAN EGRET *Egretta intermedia*	x	x	x
LITTLE EGRET *E. garzetta*	x	x	x
NIGHT HERON *Nycticorax nycticorax*	x	x	x
PAINTED STORK *Mycteria leucocephala*	x	x	x
OPENBILL STORK *Anastomus oscitans*	x	x	x
WHITENECKED STORK *Ciconia episcopus*	x	x	
WHITE IBIS *Threskiornis aethiopica*	x	x	x
BLACK IBIS *Pseudibis papillosa*	x	x	x
GLOSSY IBIS *Plegadis falcinellus*	x	x	x
SPOONBILL *Platalea leucorodia*	x	x	
FLAMINGO *Phoenicopterus roseus*	x		
BARHEADED GOOSE *Anser indicus*	x	x	
PINTAIL *Anas acuta*	x	x	
COMMON TEAL *A. crecca*	x		
COTTON TEAL *Nettapus coromandelianus*	x	x	x
REDCRESTED POCHARD *Netta rufina*	x	x	
COMMON POCHARD *Aythya ferina*	x	x	
TUFTED POCHARD *A. fuligula*	x	x	
BRAHMINY DUCK *Tadorna ferruginea*	x	x	x
FERRUGINOUS DUCK *Aythya nyroca*	x		
SPOTBILL DUCK *Anas poecilorhyncha*	x	x	x
GADWALL *Anas strepera*	x	x	

WIGEON *Anas penelope*	x	x	
SHOVELLER *Anas clypeata*	x	x	x
COMB DUCK *Sarkidiornis melanotos*	x	x	x
DEMOISELLE CRANE *Grus virgo*	x	x	x
WHITEBREASTED WATERHEN *Amaurornis phoenicurus*	x	x	x
MOORHEN *Gallinula chloropus*	x	x	
PURPLE MOORHEN *Porphyrio porphyrio*	x	x	x
COOT *Fulica atra*	x	x	x
WHISTLING DUCK *Dendrocygna javanica*	x	x	x
PHEASANT-TAILED JACANA *Hydrophasianus chirurgus*	x	x	x
BRONZEWINGED JACANA *Metopidius indicus*			x
BLACKWINGED STILT *Himantopus himantopus*	x	x	x
STONE CURLEW *Burhinus oedicnemus*	x	x	x
INDIAN COURSER *Cursorius coromandelianus*	x	x	x
REDWATTLED LAPWING *Vanellus indicus*	x	x	x
YELLOW-WATTLED LAPWING *V. malabaricus*	x	x	x
LITTLE RINGED PLOVER *Charadrius dubius*	x	x	x
KENTISH PLOVER *C. alexandrinus*	x	x	x
GREAT SAND PLOVER *C. leschenaultii*	x	x	x
CURLEW *Numenius arquata*	x	x	x
REDSHANK *Tringa totanus*	x	x	
WOOD SANDPIPER *T. glareola*	x	x	
COMMON SANDPIPER *T. hypoleucos*	x	x	x
COMMON SNIPE *Gallinago gallinago*	x	x	x
LITTLE STINT *Calidris minuta*	x	x	x
BROWNHEADED GULL *Larus brunnicephalus*	x	x	x
BLACKHEADED GULL *L. ridibundus*	x	x	x
INDIAN RIVER TERN *Sterna aurantia*	x	x	x
WHITEBREASTED KINGFISHER *Halcyon smyrnensis*	x	x	x
SMALL BLUE KINGFISHER *Alcedo atthis*	x	x	x
PIED KINGFISHER *Ceryle rudis*	x	x	x
WATER PIPIT *Anthus spinoletta*	x	x	x
GREY WAGTAIL *Motacilla cinerea*	x	x	x
LARGE PIED WAGTAIL *Motacilla maderaspatensis*	x	x	x
YELLOWHEADED WAGTAIL *M. citreola*	x	x	x
YELLOW WAGTAIL *M. flava*	x	x	x
WHITE WAGTAIL *M. alba*	x	x	x

TABLE II

PEAK POPULATION OF EACH SPECIES DURING DIFFERENT YEAR

SPECIES	JAN-JUL 1987	OCT-AUG 1987-88	OCT-AUG 1988-89
LITTLE GREBE *Podiceps ruficollis*	Jan.,14	Feb.. 06	Feb.,12
CORMORANT *Phalacrocorax carbo*	Jun..14	Jun.,08	Apr..09
LITTLE CORMORANT *P. niger*	Jun.,500	May.,152	Apr.350
INDIAN SHAG *P. fuscicollis*	Feb.,14	Feb.,08	Jan.,06
DARTER *Anhinga rufa*	Jan.,08	Jan.,03	Jan..04
GREY HERON *Ardea cinerea*	May.,68	May.,124	Jun.180
PURPLE HERON *A. purpurea*	Mar.,18	Apr.,21	Apr.,41
LITTLE GREEN HERON *Ardeola striatus*	Jan..03	Jan.,02	Jan.,02
POND HERON *A. grayii*	Apr..18	Apr.,16	Jun.,14
CATTLE EGRET *Bubulcus ibis*	Apr.,520	Mar.,200	Mar.,280
LARGE EGRET *Ardea alba*	May.,08	Apr.,04	Apr..06
MEDIAN EGRET *Egretta intermedia*	May.,19	Apr..06	Apr.,07
LITTLE EGRET *E. garzetta*	Apr..341	Mar..210	Apr.,290
NIGHT HERON *Nycticorax nycticorax*	Jan..420	Jan..150	Jan.250
PAINTED STORK *Mycteria leucocephala*	Apr.,50	Apr.,24	Jun.188
OPENBILL STORK *Anastomus oscitans*	Apr.,250	May..700	Mar..02
WHITENECKED STORK *Ciconia episcopus*	Feb.,04	Jan., 06	--
WHITE IBIS *Threskiornis aethiopica*	Feb.,08	Jan.,09	Feb..18
BLACK IBIS *Pseudibis papillosa*	Jan.,32	Jan.,19	Jan..21
GLOSSY IBIS *Plegadis falcinellus*	Feb..18	Jan.,21	Jan..22
SPOONBILL *Platalea leucorodia*	Mar.,256	Mar.,130	--
FLAMINGO *Phoenicopterus roseus*	Jan.,06	--	--
BARHEADED GOOSE *Anser indicus*	Jan.,500	Feb.,500	--
PINTAIL *Anas acuta*	Jan.,38	Jan.,44	--
COMMON TEAL *A. crecca*	Feb.,500	--	--
COTTON TEAL *Nettapus coromandelianus*	Mar,,3000	Jan.,2000	Apr1000
REDCRESTED POCHARD *Netta rufina*	Jan.,500	Jan.,68	--
COMMON POCHARD *Aythya ferina*	Feb.,80	Feb..60	--
TUFTED POCHARD *A. fuligula*	Jan.32	Jan 14	--
BRAHMINY DUCK *Tadorna ferruginea*	Jan.,1500	Jan.,800	Jan.,70
FERRUGINOUS DUCK *Aythya nyroca*	Mar.,18	--	--
SPOTBILL DUCK *Anas poecilorhyncha*	Jan.,460	Dec.,280	Dec.290

GADWALL *Anas strepera*	Jan.,19	Jan.,06	--
WIGEON *Anas penelope*	Jan.,34	Jan.,18	--
SHOVELLER *Anas clypeata*	Jan ,38	Jan.,14	Jan.,06
COMB DUCK *Sarkidiornis melanotos*	Mar.,172	Mar.,80	Feb.264
DEMOISELLE CRANE *Grus virgo*	Jan.,3000	Jan.,1500	Dec,300
WHITEBREASTED WATERHEN *Amaurornis phoenicurus*	Apr.,04	Apr.,06	Apr.,09
MOORHEN *Gallinula chloropus*	Mar.,48	Mar.,39	--
PURPLE MOORHEN *Porphyrio porphyrio*	Mar.,256	Mar.,150	Apr.,121
COOT *Fulica atra*	May.,1000	Jan.,6000	Apr.,1500
WHISTLING DUCK *Dendrocygna javanica*	Feb.,152	Jan.,58	Dec.,46
PHEASANT-TAILED JACANA *Hydrophasianus chirurgus*	Jan.,08	Jan.,04	Jan.,06
BRONZEWINGED JACANA *Metopidius indicus*	--	--	Mar.,06
BLACKWINGED STILT *Himantopus himantopus*	Apr.,32	Apr.,24	Mar.,28
STONE CURLEW *Burhinus oedicnemus*	Mar.,04	Feb.,04	Mar.,02
INDIAN COURSER *Cursorius coromandelicus*	Feb.,06	Feb.,06	Feb.,04
REDWATTLED LAPWING *Vanellus indicus*	May.,16	May.,18	Apr.,14
YELLOW-WATTLED LAPWING *V. malabaricus*	May.,04	May.,04	Apr.,02
LITTLE RINGED PLOVER *Charadrius dubius*	May.,06	Apr., 02	Apr.,04
KENTISH PLOVER *C. alexandrinus*	Feb ,08	Mar ,04	Mar.,02
GREAT SAND PLOVER *C. leschenaultii*	May.,02	May.,02	Mar.,04
CURLEW *Numenius arquata*	Feb.,03	Mar.,04	Mar.,02
REDSHANK *Tringa totanus*	Apr.,08	Apr.,04	--
WOOD SANDPIPER *T. glareola*	Apr.,06	Apr.,09	--
COMMON SANDPIPER *T. hypoleucos*	Apr.,08	May.,04	Apr.,04
COMMON SNIPE *Gallinago gallinago*	Apr.,03	Feb.,02	Feb.,06
LITTLE STINT *Calidris minuta*	May.,04	May.,02	Feb.,02
BROWNHEADED GULL *Larus brunnicephalus*	Feb.,18	Feb.,06	Feb.,06
BLACKHEADED GULL *L. ridibundus*	Feb.,14	Mar.,14	Mar.,06
INDIAN RIVER TERN *Sterna aurantia*	Feb.,38	Feb.,23	Mar.,14
WHITEBREASTED KINGFISHER *Halcyon smyrnensis*	Jan.,16	Jan.,08	Jan.,09
SMALL BLUE KINGFISHER *Alcedo atthis*	Jan.,04	Jan.,02	Jan.,03

PIED KINGFISHER *Ceryle rudis*	Feb.,18	Jan.,14	Jan.,16
WATER PIPIT *Anthus spinoletta*	Feb.,04	Feb.,03	Feb.,04
GREY WAGTAIL *Motacilla cinerea*	Jan.,04	Jan.,02	Jan.,02
LARGE PIED WAGTAIL *M. maderaspatensis*	Jan.16	Dec.,14	Dec.,12
YELLOWHEADED WAGTAIL *M. citreola*	Jan.,02	Jan.,04	Jan.,02
YELLOW WAGTAIL *M. flava*	Jan.,08	Jan.,06	Jan.,02
WHITE WAGTAIL *M. alba*	Jan.,02	Jan.,04	Jan.,02

TABLE III

OBSERVED HABITAT UTILIZATION BY WETLAND BIRDS IN MANJIRA SANCTUARY

SPECIES		HABITAT TYPES		
	1	2	3	4
LITTLE GREBE *Podiceps ruficollis*		F	F	F
CORMORANT *Phalacrocorax Carbo*	N,Rc,R	F	F	F
LITTLE CORMORANT *P. niger*	Rc,R	F	F	F
INDIAN SHAG *P. fuscicollis*	Rc,R	F	F	F
DARTER *Anhinga rufa*	Rc.R		F	
GREY HERON *Ardea cinerea*	N,Rc,R	F	F	
PURPLE HERON *A. purpurea*	Rc,R	F	F	
LITTLE GREEN HERON *A. striatus*	Rc,R	F		
POND HERON *A. grayii*	N,Rc,R	F		
CATTLE EGRET *Bubulcus ibis*	N,Rc,R	F		
LARGE EGRET *Ardea alba*	Rc,R	F		
MEDIAN EGRET *Egretta intermedia*	Rc,R	F		
LITTLE EGRET *E. garzetta*	N,Rc,R	F		
NIGHT HERON *Nycticorax nycticorax*	N,Rc,R	F		
PAINTED STORK *Mycteria leucocephala*	N,Rc,R	F		
OPENBILL STORK *Anastomus oscitans*	Rc,R	F		
WHITENECKED STORK *Ciconia episcopus*	Rc,R			
WHITE IBIS *Threskiornis aethiopica*	Rc,R			
BLACK IBIS *Pseudibis papillosa*	Rc,R			
GLOSSY IBIS *Plegadis falcinellus*	Rc,R			
SPOONBILL *Platalea leucorodia*	Rc,	F		

FLAMINGO *Phoenicopterus rosesus*	Rc,	F		
BARHEADED GOOSE *Anser indicus*	Rc,R	F	F	F
PINTAIL *Anas acuta*	Rc,R	F	F	F
COMMON TEAL *A. crecca*	Rc,R	F	F	F
COTTON TEAL *Nettapus coromandelianus*	Rc,R	F	F	F
REDCRESTED POCHARD *Netta rufina*	Rc,	F	F	F
COMMON POCHARD *Aythya ferina*	Rc,	F	F	F
TUFTED POCHARD *A. fuligula*		F	F	F
BRAHMINY DUCK *Tadorna ferruginea*	Rc,	F	F	F
FERRUGINOUS DUCK *Aythya nyroca*	Rc,	F	F	F
SPOTBILL DUCK *Anas poecilorhyncha*	Rc,	F	F	F
GADWALL *Anas strepera*	Rc,	F	F	F
WIGEON *Anas penelope*		F	F	
SHOVELLER *Anas clypeata*	Rc,	F	F	F
COMB DUCK *Sarkidiornis melanotos*	Rc,	F	F	F
DEMOISELLE CRANE *Grus virgo*	Rc,R,F			
WHITEBREASTED WATERHEN *Amaurornis phoenicurus*	Rc,R	F	F	
MOORHEN *Gallinula chloropus*	Rc,R,	F	F	
PURPLE MOORHEN *Porphyrio porphyrio*	N,Rc,R,	F,	N	F
COOT *Fulica atra*	Rc,N	N,F	F	F
LESSER WHISTLING TEAL *Dendrocygna javanica*	Rc,	F	F	F
PHEASANT-TAILED JACANA *Hydrophasianus chirurgus*	Rc,	F	F	
BRONZE WINGED JACANA *Metopidius indicus*	Rc,	F		
BLACKWINGED STILT *Himantopus himantopus*	Rc,	F		
STONE CURLEW *Burhinus oedicnemus*	N,Rc,R	F		
INDIAN COURSER *Cursorius coremandelicus*	Rc,R	F		
REDWATTLED LAPWING *Vanellus indicus*	N,Rc,R,	F		
YELLOW-WATTLED LAPWING *V. malabaricus*	Rc,R,	F		
LITTLE RINGED PLOVER *Charadrius dubius*	Rc,R,	F		F
KENTISH PLOVER *C. alexandrinus*	Rc,R,	F		F
GREAT SAND PLOVER *C. leschenaultii*	Rc,R,	F		F

CURLEW *Numenius arquata*	Rc,R,	F		F
REDSHANK *Tringa totanus*	Rc,R,	F		
WOOD SANDPIPER *T. glareola*	Re,R,	F		F
COMMON SANDPIPER *T. hypoleucos*	Re,R,	F		F
COMMON SNIPE *Gallinago gallinago*	Rc,R,	F		
LITTLE STINT *Calidris minuta*	Re,R,	F		
BROWNHEADED GULL *Larus brunnicephalus*	Rc,	F	F	F
BLACKHEADED GULL *L. ridibundus*	Rc,	F		F
INDIAN RIVER TERN *Sterna aurantia*	Re,N,R,	F		
WHITEBREASTED KINGFISHER *Halcyon smyrnensis*	N,Re,R	F		
SMALL BLUE KINGFISHER *Alcedo atthis*	Rc,R	F		
PIED KINGFISHER *Ceryle rudis*	Rc,R	F		
WATER PIPIT *Anthus spinoletta*	Rc,R	F		
GREY WAGTAIL *Motacilla cinerea*	Rc,R,	F		
LARGE PIED WAGTAIL *Motacilla maderaspatensis*	N,Rc,R,	F		
YELLOWHEADED WAGTAIL *M. citreola*	Rc,R,	F		
YELLOW WAGTAIL *M. flava*	Re,R,	F		
WHITE WAGTAIL *M. alba*	Re,R,	F		

HABITAT TYPE

1. Riverbanks tree cover, bushes, and terrestrial grass land/cultivation (includes islands).
2. Over-hanging shoreline vegetation with thick emergent vegetation.
3. Sparsely emergent vegetation with submerged vegetation.
4. Open water.

F=Feeding, N=Nesting, R=Roosting, Re=Resting.

TABLE IV

ARRIVAL AND DEPARTURE DATES OF SOME WATERFOWL IN MANJIRA

Common Name	Arrival 1986-87	Departure 1986-87	Arrival 1987-88	Departure 1987-88	Arrival 1988-89	Departure 1988-89
Brahminy Duck		April I	Dec II	Mar IV	Oct I	April II
Barheaded Geese		April I	Jan I	Jan IV		
Openbilled Stork	Jan I	July II	Dec I	Jan IV	Mar II	Mar IV
Teals		July III	Dec III	Jul II	Oct I	June III
Redcrested Pochard		April I	Feb I	Feb II		
Coots		Mar IV	Dec II	May III	Oct I	May II
Spotbill Duck		July III	Dec I	Aug (few)		Jun II

TABLE V

BREEDING RECORD AND SEASON OF WETLAND BIRDS IN MANJIRA WILDLIFE SANCTUARY

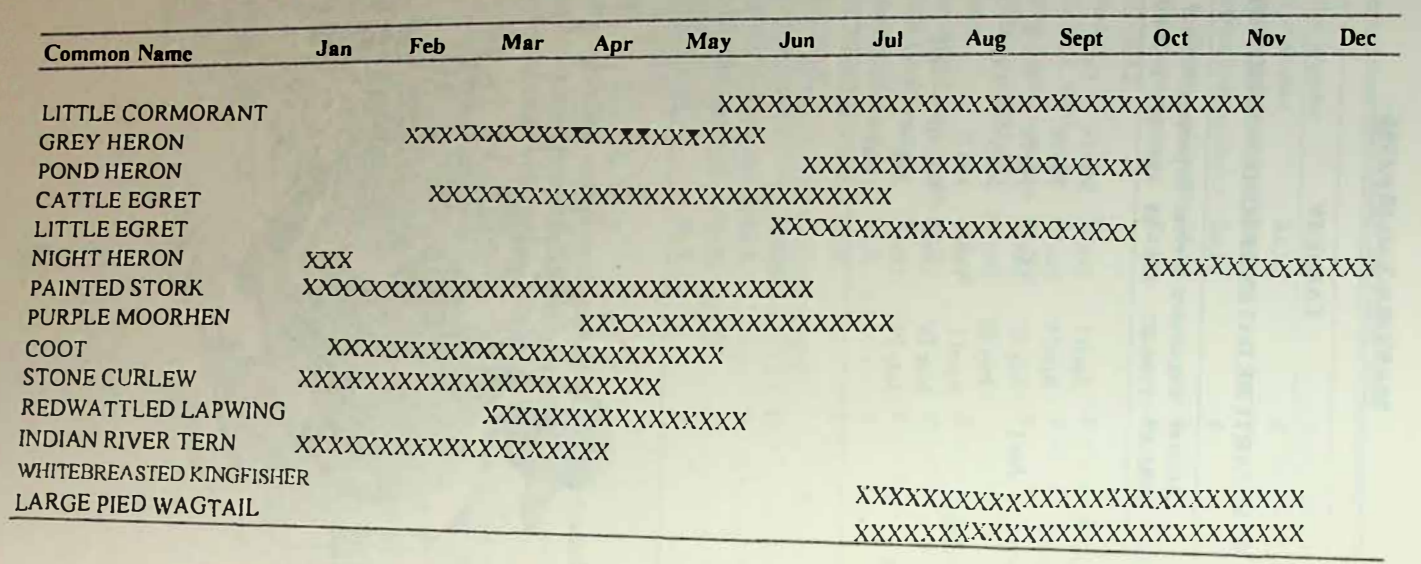

TABLE VI

LOCATION AND VEGETATION USED FOR BREEDING BY WETLAND BIRDS IN MANJIRA

Common Name	Open Ground	*Typha*	*Ipomea*	*Acacia*	*Prosopis*	Neem	Tamarind	Others
LITTLE CORMORANT				X	X		X	
GREY HERON			X					
POND HERON				X		X		
CATTLE EGRET				X			X	
LITTLE EGRET				X			X	
NIGHT HERON				X	X			
PAINTED STORK			X	X	X			
PURPLE MOORHEN		X						
COOT		X	X					
STONE CURLEW	X							
REDWATTLED LAPWING	X							
INDIAN RIVER TERN	X							
WHITEBREASTED KINGFISHER	X							
LARGE PIED WAGTAIL								X (Under the barrage)
TOTAL	4	2	3	6	3	1	3	1

SURVEY FOR THE JERDON'S OR DOUBLE-BANDED COURSER *CURSORIUS BITORQUATUS*

BHARAT BHUSHAN

INTRODUCTION

The Jerdon's or Double-banded Courser (*Cursorius bitorquatus* (Blyth) was first recorded for science by Dr. T.C. Jerdon (Blyth 1848) in *c.* 1848 "from the hilly country above the Eastern Ghats off Nellore and in Cuddapah" (Jerdon 1877). Blanford (1898) recorded the species in March 1871 near Sironcha and Bhadrachalam near the Godavari River valley in northern Andhra Pradesh. The last "presumably authentic sighting" was by Howard Campbell in 1900 in the Penner river valley near Anantapur (Ali 1977).

The 1900 record near Anantapur being the last led to the Double-banded Courser being considered as one of the rarest avian species in the world. The lack of sightings subsequent to Blanford (1898) and Campbell (Ali 1977 indicate that the Double-banded Courser is known only "from a restricted area in eastern India, from the valley of the Godavari River, near Sironcha and Bhadrachalam, and from Nellore, Cuddapah and Anantapur in the valley of the Pennar River" (Greenway 1958, Ali & Ripley 1969).

Whistler & Kinnear (1930) during the ornithological survey of the Eastern Ghats (in 1929-31) and Ali (1933-34) during his Hyderabad State Ornithological Survey (in 1931-32) had covered the known range of the Jerdon's Courser without success. Later, two "special explorations" organized by the Bombay Natural History Society (BNHS) in 1975 and 1976 with the collaboration of the Smithsonian Institution and World Wildlife Fund-India respectively, did not achieve positive results (Ali 1977). A poster prepared for the Society by J.P. Irani showing the Jerdon's with the Indian Courser, in colour, was circulated in Andhra Pradesh and adjoining states during these years without eliciting any positive response.

This continual failure to record the Double-banded Courser resulted in several authors e.g. Ripley 1952, 1961, Howard & Moore 1980, Walters 1980 and King 1981, listing the species as either extinct or thought to be as such. The possibility of this truly peninsular endemic becoming extinct was very improbable considering the vastness of potentially suitable habitat in the Lower Peninsula.

THE BNHS ENDANGERED SPECIES PROJECT SURVEY

In May 1985, the BNHS under the aegis of the Endangered Species Project decided to survey the Penner River valley areas in southern Andhra Pradesh and try to establish whether the Double-banded Courser is still present or extinct in these areas.

Towards this, preliminary surveys were carried out over the Penner River's course and its adjoins. Based on these surveys, spot-survey locations were decided upon and conducted at Somasila in Nellore district and at Siddavatam in Cuddapah district (Bhushan 1985a & b, 1986a & b).

Jerdon had mentioned the "hilly country above the Eastern Ghats, off Nellore, and in Cuddapah" and Campbell had sighted the Courser in the Penner River valley areas near Anantapur. Since the Penner River flows through Cuddapah and Nellore before emptying into the Bay of Bengal, the river's course was to be considered as the first term of reference.

The next point to be determined was the habitat-type in which to locate the Double-banded Courser. Found to inhabitat "rocky and undulating ground with thin forest jungle", Jerdon (1877) believed the Double-banded Courser to be a "mountain form of *Cursorius* frequenting rocky hills with thin jungle". Blanford (1898) recorded the species "in thin forest or high scrub, never in open ground". He "never saw any on hills", in contrast to Jerdon's belief.

Thus, going by their descriptions of the habitat-types, the Double-banded Courser would inhabit areas totally unlike those favoured by the Indian Courser. The survey had to locate hilly and low undulating ground near the Penner River or better still, comprising valley areas over the river's course through the three districts.

The visual aid used for cross-examining locals was the *Pictorial guide to birds of the Indian sub-continent* by Ali & Ripley (1983). This was used to verify the local informants' depth of knowledge, his ability to distinguish different birds at a glance and, the ability to describe each bird that the identified coupled with a local logical name.

Inquiries were followed up by walking about in the area, listing the birds seen and deciding if it would be the corrected habitat-type for the Double-banded Courser. This was alternated by examining the area from a convenient point using a spotter-scope for scanning. Equipment used included 12x50 binoculars and a spotter-scope of 10x magnification.

From the number of inquiries made during these surveys, three *shikaris* gave three versions of what may be the Jerdon's or Double-banded Courser. Of these three versions, an account of the Siddavatam locality—which turned out to be correct, is give below:

THE SIDDAVATAM AREA: CUDDAPAH DISTRICT

The Lankamalai ranges at Siddavatam are about 20km from Cuddapah. From Siddavatam, the hills range north towards the Nallamalais at Nandyal (in Kurnool district) and south to the Palakondas at Vontimitta and to Tirupati (in Chittoor district). Eleven kilometers from Cuddapah towards Siddavatam, the slopes are gentle and all the hills have scrub vegetation. This type of apparently suitable vegetation/habitat (for the Double-banded Courser) continues to Siddavatam along the foothills. The Penner River flows along the Siddavatam settlement.

Aitanna, a *shikari* (hunter) of Reddipalli village, 12km north of Siddavatam, could not recognize the Double-banded Courser, but said he knew the Lesser Florican *Sypheotides indica*, known here as '*Nela Nemili*' (*nela*=ground; *nemili*=peafowl), which was seen only in the rains. Some of the other villagers standing around, could also recognize the Lesser Florican from the *Pictorial Guide*.

I later met Pichchanna, a Yaanadi tribal, at Kumbagiri village, 4km north of Reddipalli. Pichchanna recognized the Double-banded Courser from the poster and said that it was known as '*Kalivi Kodi*'. '*Kalivi*' is the Telugu word for *Carissa*, which is the common scrub vegetation along with *Zizyphus* and *Acacia* in the area. '*Kodi*' means 'fowl'. According to Pichchanna, the name '*Kalivi Kodi*' was an apt description for the bird on account of its habit of hiding amidst the thorny *Carissa* bushes.

The *Carissa* grows to about 2-3m in height in the reserve forest areas on the foothills of Lankamalai, whereas in revenue areas, i.e., non-protected areas below the range demarcation line towards Kumbagiri, *Carissa* grows horizontally in some spots to a height of about 50cm from the ground. It was next to these low *Carissa* bushes that Pichchnna had seen the *Kalivi Kodi* and not under taller ones.

Aitanna at Reddipalli village was very encouraging. During the preliminary survey he had disclaimed knowledge of the Double-banded Courser. However in October 1985, he claimed to have kept a watch during his *shikar* trips and had sighted the *Kalivi Kodi* a number of times in the scrub forest, below the Lankamalai hills. He claimed that he sighted the birds in the night when out hunting with powerful torches. He insisted that the bird was seen feeding normally at night.

Peters (1934), Howard & Moore (1980) and Walters (1980) classify the Jerdon's or Double-banded Courser as *Rhinoptilus bitorquatus*. The congeners of the Double-banded Courser according to their *Checklist*s are the Two banded Courser *R. africanus*, Heuglin's Courser *R. cinctus* and the Bronze-winged Courser *R. chalcopterus*.

Taking into consideration the congeners' descriptions and comparing them to survey records, the Double-banded Courser was thought to be (in December 1985): found in thorn scrub country; similar in field appearance to the lapwings; a ground nesting bird with no nest-building; resting during the day under shade of a thorn tree; uncommon in areas of distribution-range and also able to evade observation successfully; and crepuscular and/or nocturnal in habit. These points were to be regarded as a reference frame for future surveys.

Elliot (1873) in his biography of T.C. Jerdon, lists the latter's army postings in detail. He states that Jerdon had "...an opportunity of seeing a part of the country difficult of access and rarely visited; and he did not neglect it as his notices of the birds of the Eastern Ghats subsequently showed."

"After passing about four years with his regiment he obtained leave of absence to visit the Nilgiri hills, where he was married in July 1841. Six months afterwards he was appointed Civil Surgeon of Nellore..."

"The wilder parts of the country between Madras and Nellore are occupied by the Yaanadis a remarkable aboriginal tribe of semi-nomad habits subsisting on the spontaneous produce of the jungles and possessing in consequence a minute acquaintance with the forms of animal and vegetable life around them. By their means Dr. Jerdon discovered many new species..."

Having thus been proved by Jerdon's biography that I was on the right track as regards the Yaanadis, there still remained the point about the geographical location, which was yet to be decided. Jerdon (1877) had claimed of procuring the bird "in the hilly regions above the Eastern Ghats off Nellore and in Cuddapah".

The Eastern Ghats

The Eastern Ghats at Cuddapah are the Velikonda ranges running north/northeast from Tirupati. The other ranges the Seshachalam, Palakonda, Nagari, Lankamalai, Nallamalais and Erramalai together with the Velikonda form the Eastern Ghats complex in southern Andhra Pradesh.

The Velikonda ranges, if regarded as the "Eastern Ghats" cancelled out the Nellore district as an area for survey. Jerdon had mentioned "off Nellore" and the Velikondas were the district boundary between Nellore and Cuddapah. The subsequent mention "and in Cuddapah" would then obviously mean a location in that district.

The only point that confused me was the mentioned of "hilly regions above the Eastern Ghats". Jerdon had been posted a Nellore. From the Nellore city any hills/hill ranges west of the Velikondas could be hilly regions "above" the Eastern Ghats if Jerdon had generalized in describing the location. Thus, the "hilly regions" would be either the Palaknodas or the Lankamalai hills.

Aitanna had gone out the night of 12th January 1986, with his colleagues for his regular *shikar*. He claimed to having seen the '*Kalivi Kodi*' in a particular area in the 'foothill-scrub' over the past few days. He had been going there daily to check their presence. His main *shikar* quarry was the Grey Partridge *Francolinus pondicerianus* and the Blacknaped Hare *Lepus nigricollis*.

This time on 12th January 1986 according to Aitanna, during a night *shikar* in Lankamalai, they flushed some partridges. The partridges rose swiftly over the scrub-line and kept flying low towards the hills. While they had their torchlights focussed on the flying birds, Aitanna heard some slight noise in a nearby bush (*c.* 20cm tall / approx. time = 01.30hrs). Lowering his torchlight he saw '*Kalivi Kodi*' standing in the torch-beam, confused and motionless. Aitanna ran up and picked the bird. He brought it back to Reddipalli village and kept it in his house. It started raining soon after this incident by early dawn and continued drizzling steadily on 13th January. Not knowing about the capture, I went ahead to Cuddapah and contacted the Divisional Forest Officer, Mr Yusuf Sharif, to make arrangements for the survey. The Siddavatam Range Officer informed me that Aitanna had caught some '*Nela nemili*' on the previous night at Reddipalli.

I started early on 15th January and rode the motorcycle in the rain to Siddavatam. The Penner was flowing above the bridge at two spots and the Siddavatam roads were in a total mess. I reached Reddipalli by 0800hrs on 15th January and went to Aitanna's house. He asked me to wait and went inside to fetch the bird.

He brought the bird in his hand. There was no disturbed movement from the bird. Its legs were dangling from between his fingers. Aitanna had tied string to its legs. The neck was low, and only the top of the head could be seen.

I had not been hoping to see the Jerdon's Courser so easily. Even with the bird in his hand it did not strike me that it could be the same. The coronal streak was not clearly visible. The black crown and the grey upper plumage were all that was visible. The pale fleshy yellow legs had no hallux. Apart from this, I was about to decide to myself that it might be some other species when the bird raised its head and starched its neck. And, there it was!

The broad white supercilium, the white throat with a broad rufous band below, followed b the narrow white semi-collar with a broad brown "gorget" below. Lifting Aitanna's hand, I could see the white collar "margined above and below with dusky below the brown gorget. There was a faint white mesial line in the centre of black crown.

Thus, finally after 86 years was the Jerdon's or Double-banded Courser locally known here as the *Kalivi Kodi* rediscovered to science.

FIRST FIELD SIGHTING

After 3 days, I reached Reddipalli at 22.00hrs along with the Siddavatam Range Forest Officer. Picking up Aitanna we went to Badvel to bring his colleagues who had gone there to get the two battery units charged and to purchase bulbs for the torches. We reached Reddipalli at 21.30hrs and prepared for the night survey.

By 24.00hrs we were nearly a kilometer inside the foothill scrub and reached the reserve forests range demarcation line. The line is about two meters wide and runs along the entire length of the demarcated Lankamalai reserve forest. The non-reserve areas are regarded as 'below' the 'range line' and reserve areas as 'above' the line. Aitanna wanted us to search both 'above' and 'below' the line alternatively. We divided into two parties with a battery unit each and went north south.

Aitanna's method was to keep walking till he reached the fringe of an open patch in the scrub. Standing beside a bush he would switch on the torch and scan the open patch. Occasionally he would shine the torch into the smaller bushes. This time he had designed a net fitted into a hoop at the end of a long pole much like an insect collection net. His colleagues carried this. I followed behind them carrying two 4-cell torches.

We kept walking for about an hour along the line till we neared the spot where Aitanna had previously collected the *Kalivi Kodi* on 12th January. It was an open patch (*c.* area = $70m^2$) circled by thorn scrub bushes (*c.* 200cm tall). Moving behind the bush-line Aitanna focussed the torch beam on the patch. Soon enough (01.30hrs) it focussed on two birds standing motionless. Turning to his colleague and taking the net from him he motioned for me to follow.

The birds stood motionless in the open patch. The torch beam never left them. The dark throat patch and the double bands characterizing the Double-banded Courser could be easily seen. Aitanna held the net stiffly next to his body. Our approach being slow enough for the birds to react, they took off just as we were 4-5m from them. As the birds flew up Aitanna's torch beam followed them along with beams from my torch and the one given to the former's colleagues. The birds broke their ascent flight and glided into the scrub about 10m towards the hills. The entire incident must have taken less than one minute.

We left the open patch and walked—with switched-off torches—towards the spot where the birds were presumed to have alighted. Each open patch was being searched quickly by a quick scan with [illegible]h beam. At approximately 02.15hrs, we sighted the two coursers again. They were in a smaller open patch full of gravel and rubble (consisting of broken fuel-wood). I

stayed behind with the third man while Aitanna rushed ahead—but failed. The birds took off the moment Aitanna broke the brush-line and stepped into the open patch.

The birds took off in a vertical take-off without any fluttering wing sound to disclose their flight. As our beams followed them they repeated the sudden break off from flight and noiselessly glided into the next open patch We could see where they had landed. The torch beam from the third man had them under focus while intervening bushes broke ours. Deciding that Aitanna's methods were not productive at that moment I asked him to avoid another attempt.

We switched off our torches and walked upto the brush line of the patch keeping the bushes between the birds and us. Aitanna and his colleague sat behind a bush and focussed on the birds. I sat behind a nearer bush and observed the birds in order to confirm that they were indeed the Double-banded Courser. I could only confirm the large eye, the dark throat patch contrasting with the two white bands and the distinct white supercilium. The characteristic courser posture decided it before the birds took off once again I must have seen them for just about 7-10 seconds.

We kept walking and trying to spot more coursers. By about 07.00hrs we had seen two Wolves *Canis lupus* one jungle cat *Felis* sp., three hares three partridges, two birds that Aitanna claimed were Stone Curlews *Burhinus oedicnemus*, one quail *Perdicula* sp., and one Caniid species that we could not identify. The other party—we met at 06.30 hrs—had not seen any Double-banded Courser.

HABITAT OF THE DOUBLE-BANDED COURSER

Jerdon (1877) mentioned "rocky and undulating around with thin forest jungle" as the habitat of the Double-banded Courser. The Lankamalais were exactly the same. The foothills had been 'worked' approx. 40-50 years ago and were yet to recover. The natural regeneration was severely affected by grazing/browsing and fuel-wood collections.

Similar habitat exists from Reddipalli to Siddavatam and Cuddapah adjuncts. North from Reddipalli, the continuity is towards Badvel and further on towards Ahobilam and other areas till the Nallamalais. East of the Lankamalais, both eastern and western sides of the Velikondas show similar vegetation and topographical features from Udayagiri to Somasila and on to Venkatagiri and Erpedu areas.

South of Siddavatam, the Palakondas show typical Double-banded Courser habitat in Nandalur, Vontimitta, Rajampet, Rayachoti and intervening areas. The other possible locations are the Jammalamadugu-Mylayaram;

Marrutla and Rapur-Rajampet areas (Bhushan 1985 a & b). Future surveys should be able to locate the Double-banded Courser in these areas.

ACKNOWLEDGEMENTS

The Bombay Natural History Society permitted me to undertake the survey under their research project on *Study of ecology of some endangered species of wildlife and their habitats*. This study received financial assistance from the Fish and Wildlife Service, U.S.A in the form of a grant (USDIFWS Grant No.8851-658-02) received through the Department of Wildlife, Ministry of Environment, Forests and Wildlife, Government of India. I am grateful to these organizations for their support.

Grateful thanks are due to Mr. J.C. Daniel, Curator, BNHS, for his encouragement and supervision throughout the many stages in the final outcome of the survey.

I am also grateful to Dr. Sálim Ali, Dr. Asad Rahmani, Mr. S.R. Nayak and Mr. P.B. Shekar.

The Andhra Pradesh Forest Department and particularly Mr. Pushp Kumar, ACCF-Wildlife, for the facilities granted, Mr. Yusuf Sharif, DFO, Cuddapah for his hospitality and help.

To my family, who never showed their anxiety at my absence during the survey, mere thanks would be insufficient.

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ROLLAPADU WILDLIFE SANCTUARY IN ANDHRA PRADESH STATE - A SUCCESS STORY IN CONSERVATION OF AN ENDANGERED SPECIES

K. JAGAN MOHAN RAO

INTRODUCTION

Andhra Pradesh State is located in the centre of India, connecting the northern and southern parts of the country. Its diversified flora, from deciduous type to semi-evergreen forests in coastal belt and moist forests in hill regions resulted in a rich fauna. The drier tracts in Rayalaseema and Telangana regions possess some rare and endangered species. The much-talked about Cheetah *Acinonyx jubatus* was seen for the last time in this region in 1952. The highly endangered Jerdon's Courser *Rhinoptilus bitorquatus* was rediscovered in January 1986 near Cuddapah, where the Lankamalleshwara Wildlife Sanctuary was established.

The last record of sighting of Great Indian Bustard *Ardeotis nigriceps* in Andhra Pradesh was by Burton in 1953 in Kurnool District. During 1982 bustards were re-sighted near Rollapadu village in Kurnool District. This area has become an important centre for protection of endangered species such as: Great Indian Bustard, Lesser Florican *Sypheotides indica*, Indian Wolf *Canis lupus* and Blackbuck *Antilope cervicapra*

GREAT INDIAN BUSTARD

Great Indian Bustard was an endemic of Pakistan and India, though it is found only in India now. Its population is estimated to be about 1,000 birds in the entire country. This bird is found in the states of Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Karnataka and Andhra Pradesh. It is listed in Appendix II of CITES and in the IUCN's Red Data Book. They are also listed under Schedule-I of Wildlife (Protection) Act 1972 and are notified as endangered species. They are three toed birds and are 10-20 kg. in weight and one meter in height. Males and females can be easily distinguished in the field. They inhabit grasslands and arid, sandy areas. They shelter near medium-height bushes. They are called *Batta meka* in Telugu. They feed on insects, lizards, grasshoppers and seeds of Red Gram, Millets, Coriander and cereals.

CONSERVATION OF GREAT INDIAN BUSTARD IN ANDHRA PRADESH

In Andhra Pradesh, Great Indian Bustards were reported from Hyderabad, Kurnool, Mahabubnagar and Anantapur districts in the past. But their presence could be confirmed only on 24th August 1982 by the Forest Department of Andhra Pradesh through the help of *Nilshikari* tribals of the area, who used to hunt the bird for livelihood.

Only three Great Indian Bustards could be sighted in this area during 1982. Since then the Wildlife Wing of Forest Department took immense care to protect the habitat and the bird. Three nests were located near Rollapadu village during 1982. A campaign was started in the area to educate the people about the importance of the bird and the need to protect it. Sign-boards were erected showing the bustards as well as Whitenecked Stork *Ciconia episcopus* which is also called *Batta Meka* in Telugu, perhaps a case of mistaken identity. All the villagers in the area were persuaded to help in the cause of conservation of these birds. Their response was spontaneous.

During 1983 the Rollapadu grasslands, where the bustards were breeding, were brought under the control of Field Director, Nagarjunasagar-Srisailam Tiger Reserve for scientific management. During this year thirteen Bustards and six nests were sighted. A careful study of movement and nesting pattern was made. *Nilshikaris* who are experts in tracking these birds were engaged as watchers to ensure not only the safety of birds but also to provide them with a means of livelihood, and to wean them away from hunting. With their help the movement of birds was monitored in Lakshmapur, Sunkesula, Tangadoncha, Cheraku Cherla, Thalamudipi, Alaganoor, Vippangandla, Bhairapuram, Middhurn, Parumanthala, Sakinala and Tharthur villages. Six watchers were engaged with a specific programme of locating birds and their nests and to protect them.

It was found that these birds preferred Rollapadu grasslands for breeding. During 1983 I saw seven birds around Banaganapalli, Kaifa, Venkatapur, Pandlapur and Nandalur villages, about 70 kms from Rollapadu. Totally, eighteen birds were reported in these areas.

The following factors are detrimental to their survival.

1. Grasslands are overrun by cattle as well as agricultural activities, causing shrinkage in their habitat.
2. These heavy ground birds can be easily sighted in their barren habitats.
3. The nuptial display of males attracts poachers.

Keeping in view the above factors, a strategy was evolved to protect their main breeding site near Rollapadu village.

AREA FOR BREEDING

Fortunately a large chunk of Government land was available near this village where bustards were nesting. This area was originally demarcated for sheep breeding. The District Collector, Kurnool was approached and he was taken to Rollapadu village and the birds were shown to him, to stress the importance of these birds in the ecosystem. He was convinced of the need to protect the habitat and allotted (1,045 acres) 402ha of Government land to protect Great Indian Bustards. The area was handed over to Forest Department on 19th October 1984. Inside this block, about 125ha of land was held by private landowners. A sum of Rs. 3.80 lakhs was deposited with the Land Acquisition Officer, Kurnool, to acquire these lands and to free the entire land from trespass and interference.

CONGREGATION OF BIRDS

During the first fortnight of July 1984 we witnessed a congregation of 40 Great Indian Bustards in Rollapadu. Scientists from Bombay Natural History Society were also present and that sight made them start a research project on Great Indian Bustard at Rollapadu. One Research Assistant was posted at Rollapadu that same year.

DEVELOPMENT OF BUSTARD AREAS

Using Drought Prone Areas Programme (DPAP) funds, a scheme was taken up to dig a trench-cum-mound (TCM) wall with Agave plantation on the mound, around bustard breeding areas. The rolling grounds near Rollapadu, fully protected from grazing and fire, induced the growth of a beautiful grassland ecosystem.

During 1985-86 thirteen bustard nests were located in the area. The success of this bustard conservation project, motivated the District Collector to close the sheep breeding project and the entire Government land, over an extent of 1,517.16 acres, was brought under the control of the A.P. Forest Department.

In 1985 we sighted a Lesser Florican another endangered member of the Otididae family, in the Rollapadu area!

The grassland, with its insect population, attracted hundreds of harriers (*Circus* spp.), which flocked here after August every year. Tanks in nearby areas such as Talamudipi, Parumanthala, Gadivemula, Sunkesula were also protected. Painted Storks *Mycteria leucocephala*, Openbill Storks *Anastomus oscitans*, Whitenecked Storks, White Storks *C. ciconia*, White Ibis *Threskiornis aethiopica*, Black Ibis *Pseudibis papillosa*, Barheaded Goose *Anser indicus*, Brahminy Duck *Tadorna ferruginea*, Pintails *Anas acuta*, Shoveller *Anas clypeata*, Tufted Pochard *Aythya fuligula*, Nukta *Sarkidiornis melanotos* and many waders could be sighted in large numbers. Particularly during January to March, Demoiselle Cranes *Grus virgo* were arriving in flocks of upto 5,000-6,000 in number. Government of Andhra Pradesh declared these areas as a Wildlife Sanctuary during July 1988.

Other endangered species of the area, Blackbuck and Wolf also increased. An initial group of seven Blackbucks multiplied to about 50 by 1989, and the population of wolves rose from 2 to 6. Measures were taken to improve water sources. One check-dam, two bore-wells and one artificial water source were created. Natural water sources (*Pade*) were improved to provide proper water to the increasing wildlife population.

During 1987-88 the conservation success of the area reached its pinnacle. The Lesser Florican bred in the area and three of their nests were located in this sanctuary. During the year there were 27 nests of Great Indian Bustard. From 1983 to March 1989, 93 nests have been located in the area. Out of these nests 28 eggs failed. Thus 65 chicks were successfully added over past 7 years. The population of bustards stabilized and it is estimated that the current population of Great Indian Bustard is more than 80 birds in this area.

It is believed that the birds are spreading over a wider range in this area. They are seen now near Muddinainipally in Anantapur District and many more areas in Kurnool District. Andhra Pradesh State Forest Department took some firm steps to win the cooperation of local people and encouraged their participation in protecting the birds.

In the last 8 years only 2 cases of poaching was noticed. Both the culprits were booked and prosecuted successfully in a Court of Law. This also helped to control the poachers effectively.

RESULTS OF MONITORING GREAT INDIAN BUSTARDS

Certain observations are made on behaviour of Bustards.

1. Population of Great Indian Bustard was noticed in Kurnool District in 3 separate areas i.e., Rollapadu, Banaganapalli and Siruvella.

2. Main breeding season is during the southwest monsoon in the months of July-August and may extend up to January.
3. A secondary-breeding season is noticed between the second fortnights of March and April. It is presumed that unsuccessful females lay eggs a second time.
4. Nests with 2 eggs were noticed twice but only one hatched.
5. Immature females lay infertile eggs.
6. Dominant males display during morning and evening hours from fixed elevated place and extend their display to late nights during moon-lit nights.
7. Non-territorial males move in separate droves.
8. Nesting mothers prefer same areas year after year.

The people of Kurnool took Great Indian Bustard as the pride of their district. On Road Transport Corporation buses Great Indian Bustard was adopted as a logo. The conservation of any species will be a continuous success if the people of the area recognize the importance of such species. This message has reached people properly and has been accepted by them. But the effort of the Forest Department of Andhra Pradesh in driving the truth into the hearts of people was made possible due to dedicated work carried out by the staff of this department and able support from the scientists of the Bombay Natural History Society.

Thus a movement built up by Forest Department successfully to save a species, otherwise threatened with extinction, resulted in saving many other endangered species.

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IMPACT OF HABITAT CHANGES ON THE WINTERING DEMOISELLE CRANES *GRUS VIRGO* IN MANJIRA RIVER— MEDAK DISTRICT, ANDHRA PRADESH

V. VIJAYA KUMAR & B.C. CHOUDHURY

INTRODUCTION

Demoiselle Cranes *Grus virgo* migrate to the Indian subcontinent during the winter months of October to March from their European and Central Asian breeding grounds (Ali & Ripley 1983; Campbell 1984). They have been reported to winter in peninsular India, including the state of Andhra Pradesh, the southern most wintering ground being Mysore in Karnataka (Ali & Ripley 1983). Demoiselle Cranes have also been reported from Medak district of Andhra Pradesh (Kumar 1985). He however doubted the identification of Demoiselle Cranes *vis-à-vis* Common Cranes *G. grus*. Rao (1984) and Kumar (1985), however, confirmed the wintering of Demoiselle Cranes in the Rayalseema area of Andhra Pradesh.

During the course of a research project of the Wildlife Institute of India, on the monitoring of reintroduced Mugger Crocodiles *Crocodylus palustris* in Andhra Pradesh, a field research station was established in 1986 at Manjira Wildlife Sanctuary in Medak District, 65km northwest of Hyderabad. In January 1987, large flocks of Demoiselle Cranes were sighted at the northwest corner of the sanctuary. These large flocks were monitored from 1987, for three successive winter seasons, with the objectives of recording

a. The arrival and departure dates
b. Aggregation pattern and flock composition
c. The dependency of these cranes on cultivated crops
d. To monitor changes in their population and the factors that alter the population.

The present paper describes how the creation of a dam across Manjira river near Singur, in the study area, has resulted in the loss of Demoiselle Crane habitat, which in turn reflected in the gradual decrease of their numbers over the years.

STUDY AREA

The study area covers 110kms^2 above the Singur dam (lies in between 17°47'N and 77°58'E) on Manjira River (Fig 1). Manjira River originates in Maharashtra and joins the river Godavari in Adilabad district of Andhra Pradesh. It has been dammed at three locations: Nizam Sagar, Kalabgoor and Singur for irrigation, water supply and power. These reservoirs have inundated vast stretches of undulating dry Deccan grasslands along its course. The availability of water has also changed the traditional land-use practices of cultivating semi-arid dry crops such as Jowar, grams and groundnut to more water-dependent crops such as paddy, wheat, chilly, cotton, turmeric, and sugarcane in the study area.

The rocky black cotton substrate of the study area experiences the southwest monsoon from June to September and receives an annual rainfall of 914.6 mm. Summer temperature rises up to 42°C and in winter reaches a minimum of 15°C.

METHODOLOGY

Following the arrival of the Demoiselle Cranes in January 1987, weekly field trips were made in the winter months and the staging areas near the Singur dam were scanned (using 8x40 binoculars) for counting the cranes. These weekly counts were made between the last week of November and the last week of March 1986 to 1989. The staging grounds were plotted on a 1km^2 grid map along the banks of the Manjira River. The flock size and composition were also recorded. To understand the crop pattern of the study area, the vegetation was examined along the river bank by transect walks. These were marked on a grid map. The sizes of flocks in each quadrat were examined against the cropping pattern in the area. Counts were also made of the other migratory waterfowl in the area.

RESULTS

Arrival and Departure

The arrival and departure time of the Demoiselle Cranes at Manjira River differed between years (Table 1). They arrived in the third week of January in 1987, but in the next season only by the second week of December, and in 1988-89 by the third week of December. Their departure time also varied between years (Table 1). During the first two seasons their wintering period in this area was more or less the same but during 1988-89 season they wintered in

this area only for half the number of days when compared to the previous seasons.

TABLE I

ARRIVAL AND DEPARTURE DATES OF DEMOISELLE CRANES IN THE STUDY AREA AND THEIR MAXIMUM NUMBERS

SEASON	ARRIVAL	DEPARTURE	MAX. NUMBER	TIME SPENT
1986-87	22.01.87	15.03.87	8,000+	83+ days
1987-88	08.12.87	28.02.88	6,000+	82+ days
1988-89	20.12.88	28.01.89	500+	39+ days

Population

Their population fluctuated considerably during these years as well as within the season. In 1986-87, about 1,000 cranes were sighted in the third week of January. Their numbers increased in subsequent weeks, reaching a maximum of about 8,000 cranes in the fourth week of February. It decreased to 2,000 in the first week of March. They left the area by the end of the second week of March (Fig 2).

In 1987-88 about 2,000 cranes arrived during the second week of December and their number increased to 6,000+ in the fourth week of December. During January 2000+ cranes were seen in all the weeks. Their numbers started decreasing during February and they left the area by the end of third week of that month. Their number during 1988-89 was less when compared to that of previous years (Fig 2).

Flock Sizes in different crop areas

Along the Manjira River bank, the cranes congregate mainly in the agricultural fields. Their flock size varied from around 50 to above 250 birds. The major congregation was recorded in the Jowar *Sorghum vulgare* fields in all the years, followed by open country lands and other crop fields (Fig. 3).

Loss of Crane habitat along the river bank.

The Singur Dam, constructed across the Manjira, started retaining water from 1987 monsoon. The major congregation sites of Demoiselle Cranes, approximately 6,000ha were submerged as a result. The cropping pattern of that area also gradually changed from semi-arid crops to arid crops. Due to the

stagnation of water and improvement of the submerged and emergent aquatic vegetation (during 1986-87), the coverage aquatic vegetation was 0.3km^2, whereas it increased to 1.875km^2 in 1987-88 (Fig 4). This favoured an increase in the number of waterfowl that used the aquatic vegetation in that area (Table 2).

TABLE II

COMPARISON OF WATERFOWL AND DEMOISELLE CRANES NUMBER IN MANJIRA RIVER IN THREE YEARS

Season	Total no. of waterfowl/ Species number	Number of Demoiselle Cranes
1986-87	984 / 28 sp.	8,000+
1987-88	2,840 / 23 sp.	6,000+
1988-89	21,976 / 28 sp.	500+

DISCUSSION

The arrival and departure time of these cranes varies between different parts of their wintering grounds. In Gujarat their arrival was recorded as early as the second week of October during 1983 (Shah, M. *et al.* 1987), whereas in Manjira their earliest arrival date was in the first week of December in 1987. Differences in their departure dates are also noticed between these two areas. The difference in the arrival and departure timings are due to several factors like the timing of breeding in their breeding grounds and the availability of suitable wintering habitats.

There was a decrease in the number of Demoiselle Crane visiting this area, from 8,000+ in 1986-87 to 6,000+ in 1987-88 and further to 500+ in 1988-89. Possible reasons for this decrease is:

a) Loss of habitat: This dam submerged a large proportion of their habitat. Initially the water covered 1.02% of their major aggregation site and it increased to 6.97% and 8.75% in 1987-88 and 1988-89 respectively.
b) Change in the cultivation pattern: An increase in the availability of water changed the cropping pattern of the area, which in turn changed availability of the preferred crops for the cranes. The most preferred vegetation-type of the cranes was the Jowar fields. Jowar crop covered 19.06% of the area

in 1986-87, which decreased to 7.16% in 1987-88 and to 3.04% in 1988-89.

c) Conditions in Demoiselle Crane staging grounds in northwestern India might have been more ideal than in the study area.

Villagers are antagonistic to cranes because of the damage they do the crops. Gradual loss of dry-riverine grasslands because of reservoirs and changed land use practices, have resulted in a drastic decline in the availability of crane habitat.

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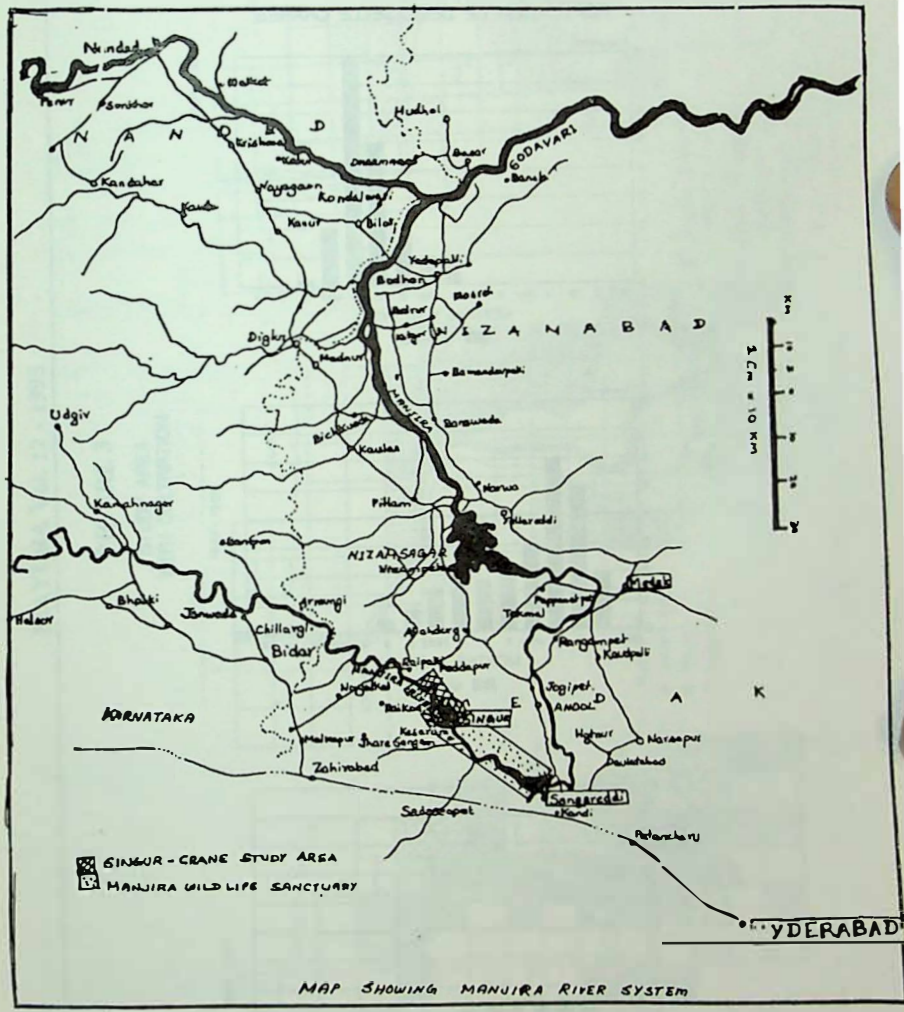
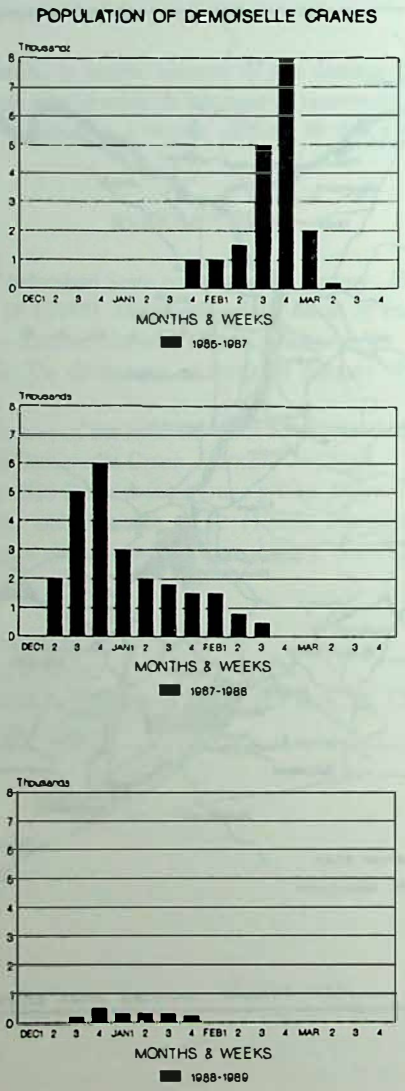
FIGURE 1



MAP SHOWING MANJIRA RIVER SYSTEM

FIGURE 2


POPULATION OF DEMOISELLE CRANES
Thousands
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MONTHS & WEEKS
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MONTHS & WEEKS
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Thousands
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MONTHS & WEEKS
1988-1989

FIGURE 3

STUDY AREA
WITH CULTIVATION

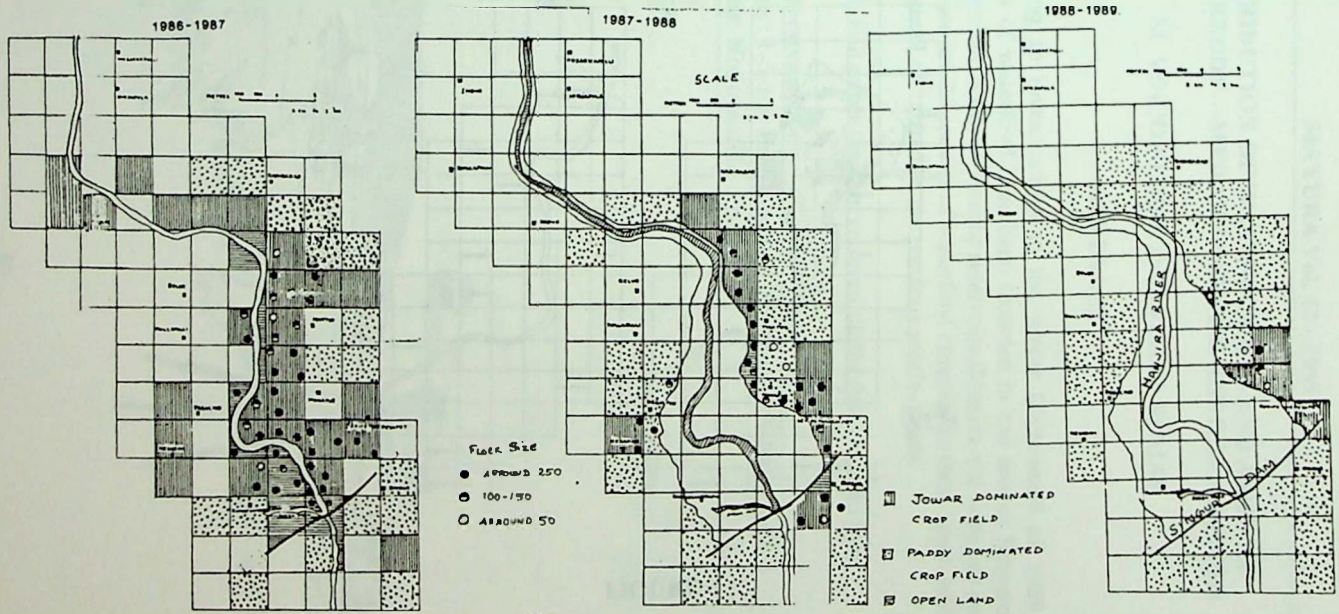

FIGURE 4

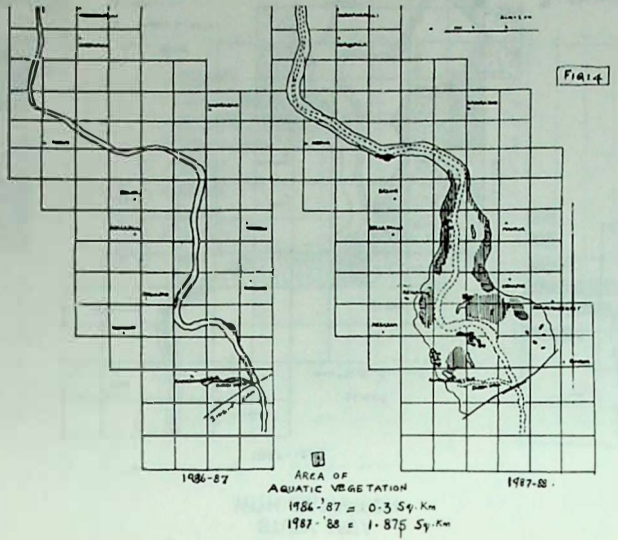
FIG:4
1986-87
1987-88
AREA OF
AQUATIC VEGETATION
1986-'87 = 0·3 Sq. Km
1987-'88 = 1·875 Sq. Km

DISTRIBUTION OF WATERFOWL IN AND AROUND SANGAREDDY—MEDAK DISTRICT, ANDHRA PRADESH

M. VINOD KUMAR & V. VIJAYA KUMAR

ABSTRACT[1]

According to investigations in the winter (December) of 1989, 25 species of waterfowl have been recorded in and around Sangareddy. This year we covered 2 major reservoirs (Manjira and Singoor) and 10 small tanks. There are 25 species of waterfowl observed in these areas, which is relatively very small compared to the previous year's counts.

[1] Editor's Note: Full paper was not received till the date of publication.

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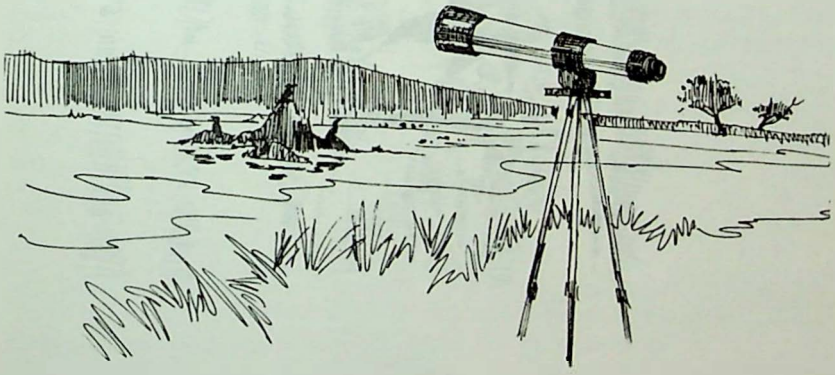

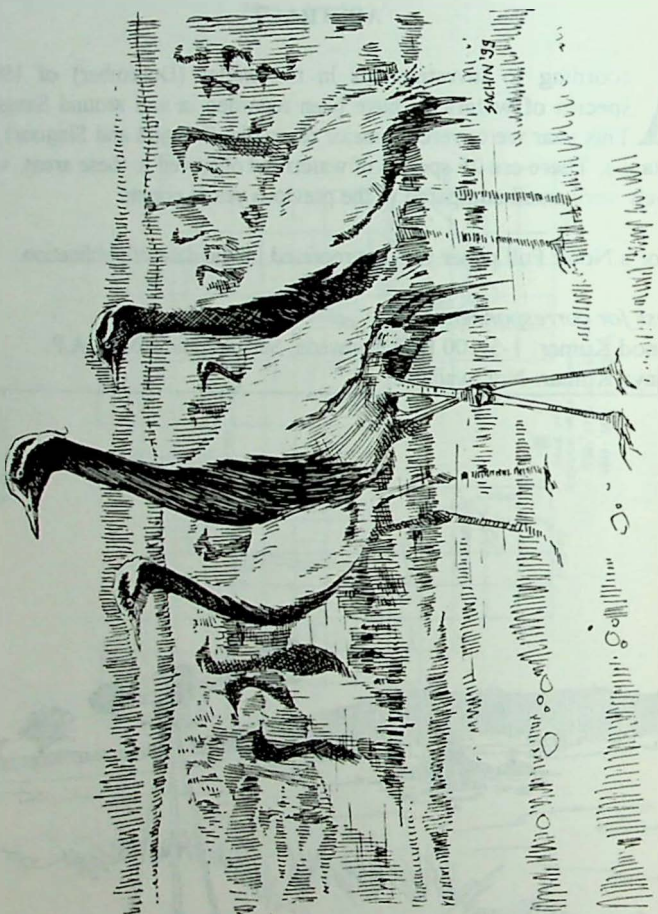

III

CONSERVATION

PERSPECTIVES

FEEDING BEHAVIOUR OF ROSY PASTORS *STURNUS ROSEUS* ON NECTAR OF *BOMBAX CEIBA*

T. GANESH

ABSTRACT

Flowering Red Silk Cotton *Bombax ceiba* trees were observed to determine the effect of nèctar volume, floral density, flock size and presence of competitors on the foraging behaviour of Rosy Pastors *Sturnus roseus*.

Feeding behaviour, as measured by time spent on the tree, is not solely dependent on nectar volume. Feeding time also increases with flock size and with floral density, when the range of floral density is large. Intra-specific interactions interfere with feeding time. The birds employ two strategies for feeding—dominants are territorial while subordinates (immature) prefer to feed in flocks. Thus the foraging behaviour of Rosy Pastors on Red Silk Cotton trees is dependent on a complex network of ecological and behavioural factors.

INTRODUCTION

Interaction between flower and avian visitors has provided interesting insights into the complex co-evolutionary relationship that exists between them (Feinsinger 1987). Many species of hummingbirds in neotropics and sunbirds in paleotropics are obligate nectarivores and often there is a close relationship between them and the plants they visit (Stiles 1978, Feinsinger 1987). Similarly many plant species in India also show adaptation to bird visitors (Ali 1932). However there are even larger assemblages of plant species that get visited by non-obligate nectarivores. The foraging behaviour of these has never been looked at in detail.

In the present study, many characteristics of the tree, flower and the birds are analyzed to understand the foraging tactics of a non-obligatory nectarivore, Rosy Pastor on super abundant nectar of *Bombax ceiba*.

STUDY SITE

This study was conducted 8km north of Secunderabad (Andhra Pradesh) near the village of Alwal between 14th February and 9th April 1989. The site was a scrub country interspersed with wooded patches and open fields.

DESCRIPTION OF STUDY SYSTEM

Bombax ceiba (Family: Bombacaceae) are tall deciduous trees which come into flower for a brief period from early February till April. This coincides with the arrival of migrant Rosy Pastors in great numbers which feed extensively on flower nectar. The flowers also attract other species like Palm Squirrels *Funambulus* spp., and bats (Chiroptera) apart from birds. The *Bombax ceiba* flowers are bright crimson and grow in clusters on short thick stalks. They are inaccessible from the ground hence very difficult to manipulate in great numbers without adequate equipment.

The diet of Rosy Pastor varies widely from fruits of different species to insects like locusts. When *Bombax*, *Erythrina* and *Butea* are in flower, Rosy Pastor restricts its diet to nectar thereby helping in pollination (Abdulali 1947, Ali & Ripley 1987).

METHODS

Nectar measurements

Nectar volume and secretion rates were calculated from controlled flowers. Control was established by bagging buds, which were about to bloom. A 2ml syringe was used to measure nectar volume at 7.00hrs, 12.00hrs and 17.00hrs and until the flower stopped secreting. During each sampling period, nectar was completely removed from flowers that were re-bagged to protect from nectar robbery.

Floral density estimation

This was estimated each day before observation on the birds began by counting flowers on a small branch through binoculars and extrapolating to the whole tree. Number of flowers was assumed to be constant throughout the day.

Behaviour

A bird was selected at random and followed with binoculars until it was lost or five minutes had elapsed (Caraco 1979). Sampling was done from 7.00hrs to 18.00hrs. During each sampling the following parameters were recorded.

Feeding time

The time spent by a bird pecking at flowers. Each peck approximately represented 1sec. This is because, unlike sunbirds, these do not suck nectar. Instead they run it down their throat by lifting their bill skywards. Distance moved by the bird approximate to 0.5m, interference or chase is taken as an event. +INT means the bird chased another and -INT means bird was chased.

Birds involved in the chase were also recorded. Time was measured with a stopwatch but during high activity a tape recorder was used and later transcribed.

RESULTS

Nectar levels

Nectar was abundant in each bagged flower and ranged from 0.2ml to 3.8ml in 8 flowers at each sampling interval. There was however considerable variation in the nectar levels between trees ($z = -4.11$, $p < 0.002$ two tail). Of the three trees from which nectar levels could be obtained, the smallest tree (BC-4, Table 1) had more nectar ($x = 2.98 \pm 0.66$) in the morning compared to the two bigger trees ($x = 0.42 \pm 0.21$). In the afternoon and evening similar differences existed (1.59 ± 0.60 in the small tree and 0.25 ± 0.06 in two big trees). This indicates that bigger trees with more flowers seem to produce less nectar per flower.

Nectar volume declines significantly (Figure 1) in the afternoon (Mann-Whitney $U = 62$ $N = 16$ $p < 0.001$, 1 tail) and stays the same in the evening ($U = 47.5$ $N = 16$ $p > 0.05$). But, nectar secretion rate does not change significantly through the day and remains at $x = 0.17 \pm 0.14$ ml/hr.

Each flower produces 3 ± 2.52 ml of nectar over a mean period of 22.00hrs. Flowers that have little or no nectar unfurl their petals and fade but remain in the tree for another two or three days. At any time only a smaller proportion of flowers on the tree produces nectar.

Floral density

Feeding observations were done on four different trees (BC-1, BC-2, BC-3, and BC-4) whose floral density ranged from 266 flowers to 6,000 flowers. There was some overlap in floral density between two trees BC-3 and BC-4.

Feeding

The main parameter taken into consideration for measuring feeding activity of the bird was the percentage of time the bird fed. The percentage is expressed over the total sampling period. Figure 2 shows the variation of % feeding time over a day (Data pooled from 618 birds, sampled in 176hrs of observation). Percentage feeding time in the morning does not change between hours but sharply rises between 16.00hrs-18.00 hrs despite low nectar levels during these hours. The number of birds also increases dramatically (Figure 3) during this time and defense of any patch is not stable and consistent. Birds coming to feed do not show any fidelity to the tree in the evening and spend time feeding on the ground.

Feeding vs. floral density

Feeding time increases with number of flowers ($r=0.76$, $n=34$ $p<0.05$, Figure 4). In trees with large number of flowers the birds fed for a longer period of time (Table I).

Flock size and feeding time

Rosy Pastor, when in a flock, feed more ($r=0.53$, $n=34$, $p<0.05$). Flock size increases in the morning and evening as birds visit the trees while going to or coming from their roost site about 8km away (Figure 3). The mean flock size of birds was 106 in the evenings while it was only around 56 in the morning. Many birds in large flocks were immature or female birds as inferred from their plumage colouration (Ali & Ripley 1987).

Bird visits to the tree also depends on the location of the tree. Maximum increase in flock size was noticed in BC-2 and to a lesser extent in BC-1; but not in other two trees. BC-1, BC-2 and BC-3 lie on the regular 'flyway' to roosts used by the birds. But BC-2 lies in open scrub habitat and attracts a large number of ground-feeding Rosy Pastors that visit the tree frequently. Ground feeding is usually done between 6.30hrs and 8.30hrs and again between 16.30hrs and 18.00hrs.

Territoriality

During late mornings and early afternoons patches of flowers are defended. When a large number of birds are on the tree, defense is less successful and a smaller number of flowers are successfully defended. By confining itself to a small area (patch defense), the bird moves less distance per flower (D/Fv) thereby marginally increasing its feeding time ($r=-0.34$ $p>0.1$). At these times the birds show high degree of site fidelity and often return to the same patch when disturbed from the tree. In one case a pair of birds defended the same patch of flowers daily from morning till noon for ten days. It is however not known whether the pair consisted of the same birds.

Floral density, Rosy Pastor and D/Fv

It was seen that D/Fv is negatively correlated to feeding time therefore any factor increasing D/Fv should decrease feeding time. It is logical to assume that floral density should be one of the factors, but pooled results from all trees indicate that there is no strong correlation between floral density and D/Fv ($r=0.02$, p=ns). However, when analyzed tree-wise, at the end of the flowering period the average distance moved per flower (D/Fv) increases ($r=0.40$ $p>0.05$). This was noticed in BC-2 and BC-3. With flowers becoming increasingly sparse when floral density decreases birds abandoned the trees. This happened at different floral densities and is in proportion to the size of the

tree. There were 1,900 flowers in BC-1 (largest) when birds abandoned the tree, 900 in BC-2, 300 in BC-3 and 266 in BC-4 (smallest).

Among Rosy Pastors, dull coloured birds (immature, females) would visit the trees often and feed longer (9sec) than the territorial birds (4sec). This was most evident in BC-4 where the overall average feeding time increased to 8.33sec from 4.88sec the previous day, mainly because of dull coloured birds, every thing else being nearly constant.

Interference, flock size and feeding time

Interference occurs mostly when a bird defends a patch against intruders. It is more an indicator of bird activity, as it does not include the time spent in chase or aggression. By patch defense the bird excludes other competitors from its feeding area. But often it is not possible to do so against larger birds and only smaller birds are easily excluded from its patch, i.e. body size of the competitor increases its success in defending a patch. Interference increased with flock size of Rosy Pastor ($r=0.82$, $p<0.05$, Figure 6) and so did feeding time ($r=0.53$, $p=0.05$). When a patch could not be defended either due to competitor size or frequency of intrusion, Rosy Pastors coped with competitors in the same patch and is a reason for the increase in feeding with interference.

More than 80% of the interference events are intra-specific of which 53% are +INT i e. the bird chases off other usually dull coloured Rosy Pastors. Inter-specific events are much lower: Common Myna *Acridotheres tristis* (8%), squirrel (4%) and other bird species (9%). Rosy Pastors are only partly successful in some inter-specific encounters. In the interference between Rosy Pastors and Common Mynas, the latter fed in the patch without being chased 78% of the time. For squirrels this was only 17%.

Inter tree variation in feeding time

The four trees differed mainly in the number of flowers. Feeding time and factors such as D/Fv, flock size, number of other birds also differed significantly between trees (Table 1). Feeding time showed significant variation between BC-1 and BC-2 (Mann-Whitney U test, 2-tail, $U=119$, $N=25$, $p<0.02$) and between BC-2 and BC-3 ($U=191$, $N=28$, $p<0.02$) but the differences between BC-3 & BC-4 were not significant ($U=103$, $N=25$, $p<0.05$). There was also no significant variation in number of flowers on BC-3 as compared with BC-4 ($U=22$, $N=12$, $p<0.05$) and between other trees which further emphasizes the fact that feeding time is dependent on floral density.

DISCUSSION

The broad strategies adopted by Rosy Pastors for feeding on flower nectar are basically two: territoriality and flock feeding. The recent conceptual framework of territoriality is economic defensibility (see Krebs and Davies 1987); the idea is that the cost of holding a territory should be less than the gain obtained. Territoriality is unrewarding for the bird when the cost is very high because it can acquire the benefit without the cost of defending the patch. This happens in dominant Rosy Pastors when interference increases, making defense of patch more costly. Territoriality is also not profitable at very low density because costs become too high compared to the returns from the patch (Feinsinger 1987). This might be a reason for Rosy Pastors to abandon trees at varying floral density as the reward from a patch decreases even though there may be many flowers in the tree but cost of flying and defense of such flowers becomes expensive.

Territoriality in Rosy Pastor is not only a matter of resource availability but also of individual competitive ability. Territorial birds need to be aggressive to defend patches from other birds (Caraco 1979). Aggressive birds, which are brightly coloured and dominant, defend patch from dull coloured birds (immature?). These dominants, by patch feeding, can increase predictability in resource and reduce variance in feeding time (Caraco 1979). Such a foraging pattern by Rosy Pastor is seen to be the predominant strategy in the mornings and evenings. These birds might also derive other benefits by being territorial, like time to vocalize, which is an integral part of the dominant birds' behaviour and might be a substantial contributor in their reproductive success (Ganesh 1989, Whistler 1986).

The dull coloured birds on the other hand can be considered as subordinates with inferior competitive ability. Subordinates can overcome competitive advantage of dominants by flock feeding (Krebs and Davies 1987 pp. 96 & 124, Caraco 1979). Flock feeding can be advantageous because sampling effort is pooled and the sampling effort of the individual is decreased (Feinsinger 1987). Rosy Pastors flock feeding in the evenings (16.00hrs-18.00hrs), could be subordinate non-territorial birds as seen from their plumage. These do not interfere with other dull coloured birds and therefore interference decreases when these subordinate birds visit the tree after 16.00hrs. Subordinate birds were also noticed to forage in flocks (about 100) on a fruiting *Ficus religiosa* tree.

Thus Rosy Pastors that are brighter in colouration benefit from feeding on Silk Cotton flowers and selection of trees by the birds in general is a function of its floral density and location.

ACKNOWLEDGEMENTS

I am grateful to Dr Priya Davidar for her encouragement, advice and critical comments on the paper. I thank Dr Trevor Price and Soubadra for their many comments on an earlier draft. Siraj, Aasheesh and other members in BSAP and of course P. Kanniah in the field, helped me in numerous ways; I thank them all a lot.

TABLE I

INTER-TREE DIFFERENCES IN *BOMBAX CEIBA*

Tree	# of flowers*	no. birds	Feeding %	D/Fv (m)	Flock size	Other birds
BC-1	6,000	42	10.67	0.96	09	19
BC-2	2,325	183	04.34	1.98	05	03
BC-3	820	187	07.63	1.41	16	01
BC-4	473	133	03.24	0.79	04	02

* Peak flowering.

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Fig 1. Nectar production patterns over a day in Bombax flowers.

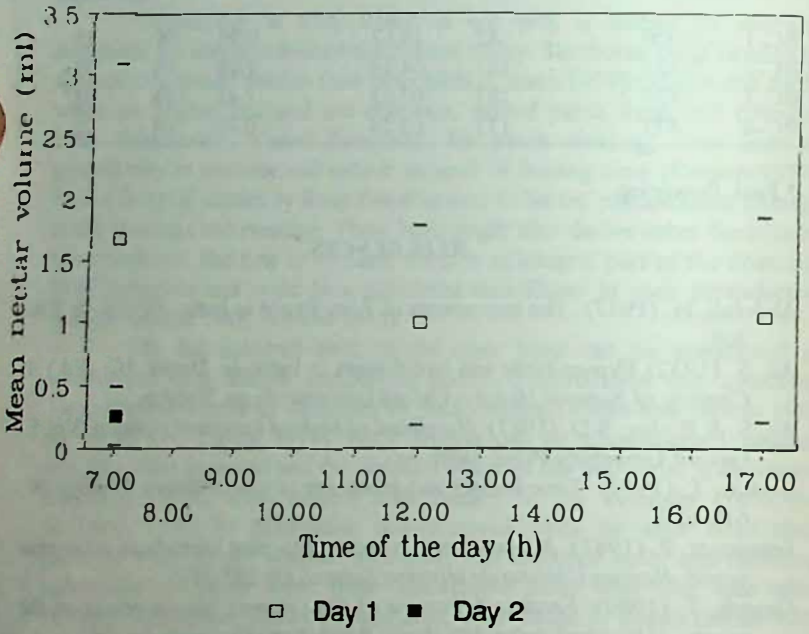


Fig 2. Mean time spent feeding on nectar of Bombax flowers

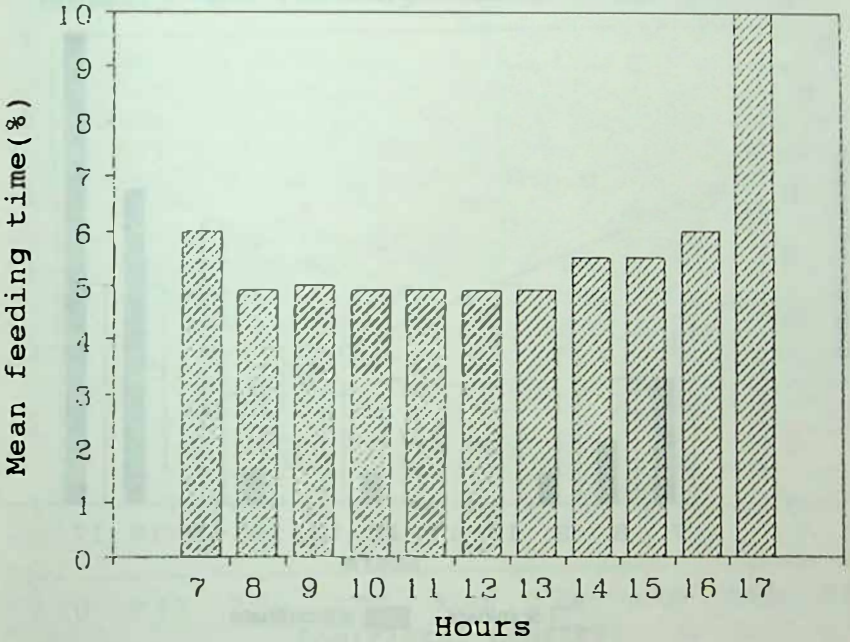


Fig 3. Mean number of Dominant and subordinate birds over a day in Bombax

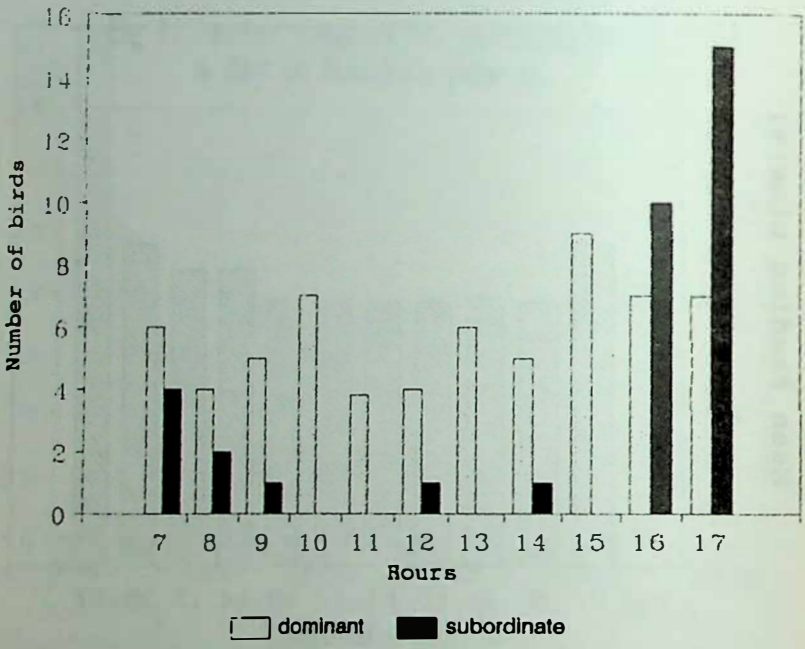
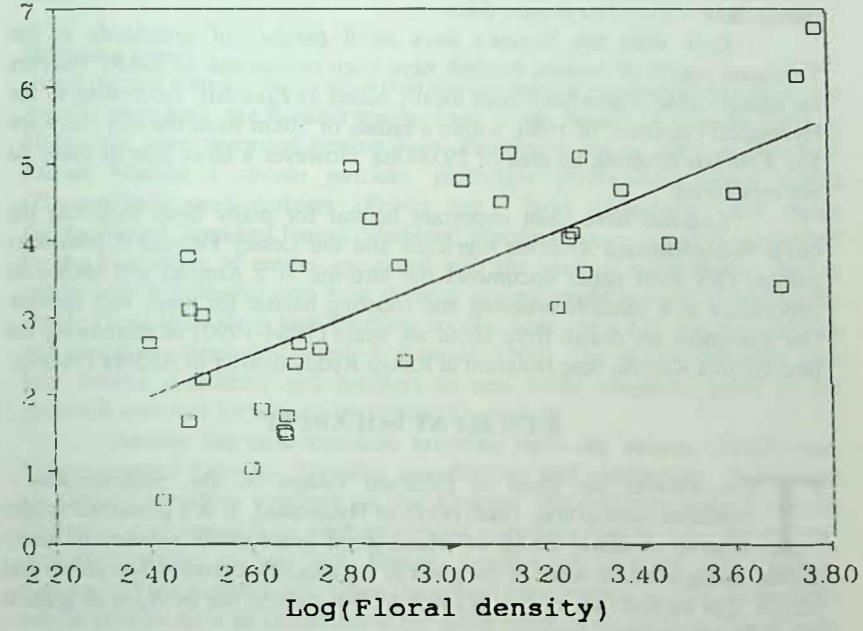


Fig 4. Relation ship between floral density and feeding time of Rosy Pastor



IMPORTANCE OF *KANCHAS* IN BIRD CONSERVATION

P. KANNIAH & T. GANESH

ABSTRACT

Kanchas are grasslands in the Telengana region of Andhra Pradesh. More than one hundred species of birds have been recorded here in a year. It is one of the most important roosting site for Harriers *Circus* spp., wintering site for Shorteared Owl *Asio flammeus* and breeding sites for number of ground birds.

Many *Kanchas* have vanished due to agriculture, housing and industries. Those existing are under threat from humans and natural succession. Hence there is a need to protect them.

Ever since the Nizam's days small patches of grasslands in the Telengana region of Andhra Pradesh have been maintained as fodder reserves for village cattle. These have been locally called as *Kanchas*. According to the Hyderabad Gazetteer of 1980, within a radius of 50km from the city there are 103 *Kanchas* covering an area of 29,000ha. However a large part of these do not exist today.

Kanchas have been important habitat for many birds including the Great Indian Bustard *Ardeotis nigriceps* and the Lesser Florican *Sypheotides indica*. This short paper documents the bird-life at a *Kancha* and shows its importance as a valuable breeding and roosting habitat for many bird species. Our inferences are drawn from about six years (1984-1990) of monitoring the bird-life of a *Kancha* near Bolarum in Ranga Reddy district of Andhra Pradesh.

KANCHA AT BOLARUM

This *Kancha* lies close to Bolarum village on the Secunderabad—Medchal railway line, 18km north of Hyderabad. It is a protected fodder reserve of nearly 280ha of which good grass cover extends to about 200ha. Being a fodder reserve, the grass is cut annually between November and March. The harvest can last for as much as five months but by April all grass is removed leaving only clumps.

Bird-life at the *Kancha*

We sampled the bird-life at the *Kancha* by crisscrossing it at least twice every month from 1984-1990. More than 80 species of birds have been recorded (see Table 1). Those flying above the *Kancha* or flying to and from roost sites *etc.*,

were not included. Raptors were the most species-rich group, which includes all the species of Harriers recorded in Andhra Pradesh. These are followed by the babbler (Timaliinae) and warbler (Sylviinae) group. Numerically the maximum number of birds and species occurs in November when breeding birds and the migrants are both seen. Later in the season breeding birds become less common and only migrants are noticed. During peak summer in May, there is very little cover in the *Kancha* and bird-life generally shifts to adjacent gardens and scrub during the day. This is the time of lowest species richness.

Kanchas attract birds because they are breeding grounds for many ground-dwelling birds like sandgrouse (Pteroclididae) and larks (Alaudidae) and also for those, which use the grass clumps for nesting, like the Streak fantail warblers. It also acts as a roosting site for many resident and migrant birds.

Breeding Birds

After the hot summer when rains turn the dry landscape into a carpet of tender grass in early June, the *Kancha* springs back to life. Nearly 14 species (17%) of birds have been recorded nesting here. Prominent among them is Streaked Fantail Warbler *Cisticola juncidis*, partridges (*Francolinus* spp.), quails (Phasianidae), wren-warblers (*Prinia* spp.), larks (Alaudidae) and pipits (Motacillidae). Streaked Fantail Warblers' breeding season is tightly controlled by the availability of tender grass and also the need of some thorny thicket nearby which probably acts as a defense against predators and trampling by cattle. These birds show high hatching success here and a pair raises more than one brood in a season (Ganesh & Kanniah 1990). The scattered bushes also help shrikes (Laniidae) and babblers to nest while telephone posts in the grassland are used for nesting by mynas (Sturnidae).

Among the post-monsoon breeding birds are munias (Estrildinae), Yellow-wattled Lapwing *Vanellus malabaricus* and sandgrouse. Sandgrouse are definite breeding migrants to this *Kancha*. Whereas the Indian Coursers *Cursorius coromandelicus* probably breed elsewhere but fly into the *Kancha* with their young in July and August. Sandgrouse, coursers and lapwings migrate into the *Kancha* only when the annual grass cutting is over. Some birds can be seen as early as December if the grass cover is cut by then. These birds appear to use the *Kancha* to protect their young ones from predators as these young birds camouflage very well with the surroundings.

Roosting birds

More than 43 species (51%) of birds have been noticed utilizing the grass or the thickets to roost (Table 1). Prominent among these are harriers that roost in the *Kancha* between September and April. The maximum number of these birds

roosting has been over 200 in certain years. Five species of harriers roost here, of which the Pied Harrier *Circus melanoleucos* is the rarest.

The tall grass is essential for the harriers to roost. Once the grass is cut at their roost site, the birds move to where the grass is still intact. The grass not only hides the roosting birds and gives them protection, the birds also use the grass stalks to make a kind of 'bed' for roosting.[1]

Another important wintering species that roosts here is the Shorteared Owl. They are encountered between February and April. They remain hidden in grass clumps during the day and fly out around dusk. Occasionally the Great Horned Owl *Bubo bubo* also comes and roosts near boulders in the grass.

Among other roosting species a mention of migrant pipits and Short-toed Larks *Calandrella cinerea* is essential. Prior to the roosting of harriers, some 200+ pipits gather on the power-line at dusk and then disappear into the grass to roost. Similarly communally roosting Short-toed Larks, ranging between 80 to 100 birds, 'buzz' at dusk over the cut grassland to find a suitable place to roost. These are however seen only after the fodder harvest is over.

Small thickets of *Zizyphus* sp., shelter many solitary roosters like shrikes (Laniidae), bushchats (*Saxicola* spp.), warblers and at times even Redrumped Swallows *Hirundo daurica*.

THREATS

The major threat to *Kanchas* comes from encroachment for plantation, dry-land farming and real estate development. In many places natural succession also decreases grass cover by increasing scrub growth. There are also other forms of disturbance for example the *Kancha* at Dundigal has been occupied by Indian Air Force and a runway cuts through the grassland. At the Bolarum *Kancha*, part of the area has recently (1989) been planted with *Acacia* spp., and *Eucalyptus* spp., while another part has been ploughed to plant *Jowar*. Fortunately *Jowar* was never planted but the plantation seems to be coming up. Further disturbance has come in the form of a surfaced road linking NH-7 and Siddipet road *via* Bolarum. This has almost dissected the *Kancha* into two halves and we feel this could spell doom to this habitat soon.

Can we afford to loose these *Kanchas*? Even though they are small, *Kanchas* could be important for overall bird conservation. Not only they support both breeding and roosting requirements of many species, they could also be important stop-over points for long distance migrants. For instance, *Kanchas* form important roost sites for harriers and the short-eared owl. These harriers might be using the small grasslands as stop-over roost points on their migration to larger grasslands like Rollapadu in Kurnool district. Its now known that the lack of such protective recuperative sites for migrant birds on

their long distance migration, can lead to population decline in the long term. Can we let this happen to our winter visitors?

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[1] Editor's Note: These observations require further clarification, as they seem contradictory to published literature.

TABLE I

CHECK LIST OF BIRDS AT THE BOLARUM *KANCHA*

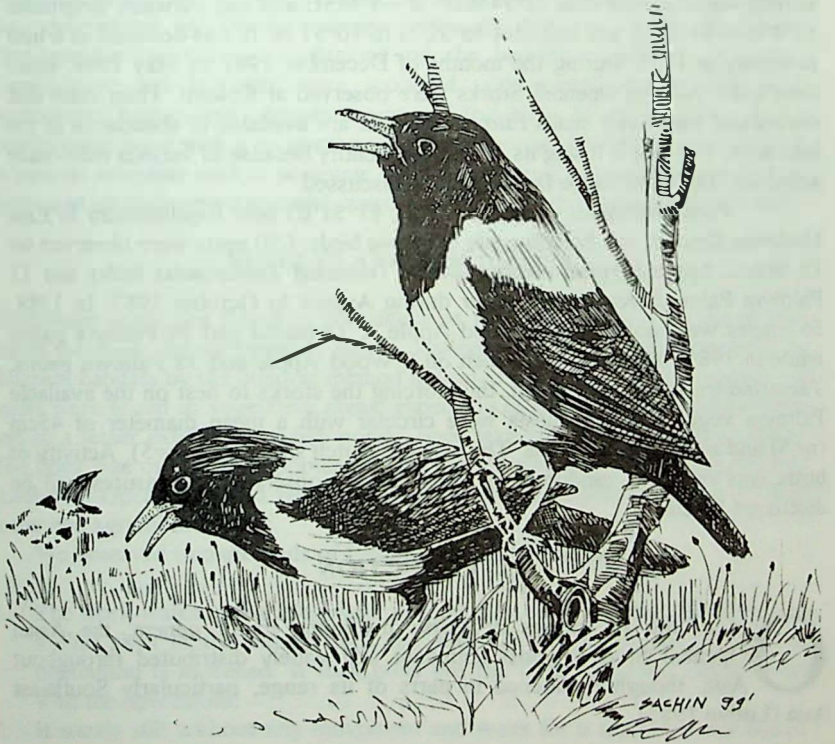
Species	Breeding	Roosting
ARDEIDAE		
1. Pond heron *Ardeola grayii*	-	-
2. Night heron *Nycticorax nycticorax*	-	-
3. Cattle egret *Bubulcus ibis*	-	-
4. Little egret *Egretta garzetta*	-	-
ANATIDAE		
1. Spotbill duck *Anas poecilorhyncha*	-	-
ACCIPITRIDAE		
1. Blackwinged Kite *Elanus caeruleus*	-	+
2. Pariah Kite *Milvus migrans*	-	-
3. Brahminy Kite *Haliastur indus*	-	-
4. White-eyed Buzzard Eagle *Butastur teesa*	-	+
5. Tawny Eagle *Aquila rapax*	-	-
6. Hen Harrier *Circus cyaneus*	-	+
7. Pale Harrier *C. macrourus*	-	+

8. Montagu's Harrier *C. pygargus*	-	+
9. Pied Harrier *C. melanoleucos*	-	+
10. Marsh Harrier *C. aeruginosus*	-	+
11. Short-toed Eagle *Circaetus gallicus*	-	-
FALCONIDAE		
1. Redheaded Merlin *Falco chicquera*	-	-
2. Kestrel *F. tinnunculus*	-	+
PHASIANIDAE		
1. Rain Quail *Coturnix coromandelica*	+	+
2. Jungle Bush Quail *Perdicula asiatica*	+	+
3. Grey Partridge *Francolinus pondicerianus*	+	+
4. Painted Partridge *F. pictus*	-	+
BURHINIDAE		
1. Stone Curlew *Burhinus oedicnemus*	+	+
GLAREOLIDAE		
1. Indian Courser *Cursorius coromandelicus*	-	+
CHARADRIIDAE		
1. Redwattled Lapwing *Vanellus indicus*	-	+
2. Yellow-wattled Lapwing *V. malabaricus*	+	+
3. Little Ringed Plover *Charadrius dubius*	-	-
4. Green Sandpiper *Tringa ochropus*	-	-
5. Wood Sandpiper *T. glareola*	-	+
6. Common Sandpiper *T. hypoleucos*	-	+
PTEROCLIDIDAE		
1. Indian Sandgrouse *Pterocles exustus*	+	+
COLUMBIDAE		
1. Blue Rock Pigeon *Columba livia*	-	-
2. Spotted Dove *Streptopelia chinensis*	-	-
3. Little Brown Dove *S. senegalensis*	+	+
CUCULIDAE		
1. Pied Crested Cuckoo *Clamator jacobinus*	-	-
2. Common Hawk-Cuckoo *Cuculus varius*	-	-

STRIGIDAE		
1. Barn Owl *Tyto alba*	-	-
2. Great Horned Owl *Bubo bubo*	-	+
3. Spotted Owlet *Athene brama*	-	+
4. Shorteared Owl *Asio flammeus*	-	+
CAPRIMULGIDAE		
1. Common Nightjar *Caprimulgus asiaticus*	-	-
APODIDAE		
1. Palm Swift *Cypsiurus parvus*	-	+
ALCEDINIDAE		
1. Whitebreasted Kingfisher *Halcyon smyrnensis*	-	-
MEROPIDAE		
1. Small Green Bee-eater *Merops orientalis*	-	-
CORACIIDAE		
1. Indian Roller *Coracias benghalensis*	-	-
UPUPIDAE		
1. Hoopoe *Upupa epops*	-	-
ALAUDIDAE		
1. Redwinged Bush-lark *Mirafra erythroptera*	-	+
2. Ashycrowned Finch-Lark *Eremopterix grisea*	+	+
3. Rufoustailed Finch-Lark *Ammomanes phoenicurus*	-	+
4. Eastern Skylark *Alauda gulgula*	+	+
5. Short-toed Lark *Calandrella cinerea*	-	+
HIRUNDINIDAE		
1. Redrumped Swallow *Hirundo daurica*	-	+
2. Common Swallow *H. rustica*	-	-
LANIIDAE		
1. Grey Shrike *Lanius excubitor*	+	+
2. Baybacked Shrike *L. vittatus*	-	-
3. Brown Shrike *L. cristatus*	-	+

DICRURIDAE		
1. Black Drongo *Dicrurus adsimilis*	-	-
ARTAMIDAE		
1. Ashy Swallow-Shrike *Artamus fuscus*	-	+
STURNIDAE		
1. Common Myna *Acridotheres tristis*	+	+
2. Brahminy Myna *Sturnus pagodarum*	-	-
CORVIDAE		
1. House Crow *Corvus splendens*	-	-
2. Jungle Crow *C. macrorhynchos*	-	-
PYCNONOTIDAE		
1. Redvented Bulbul *Pycnonotus cafer*	-	-
MUSCICAPIDAE		
1. Common Babbler *Turdoides caudatus*	-	+
2. Large Grey Babbler *T. malcolmi*	-	-
3. Whiteheaded Babbler *T. affinis*	-	-
4. Streaked Fantail Warbler *Cisticola juncidis*	+	+
5. Franklin's Wren-Warbler *Prinia hodgsonii*	-	+
6. Plain Wren-Warbler *P. subflava*	+	+
7. Grass Warbler?	-	-
8. Blyth's Reed Warbler *Acrocephalus dumetorum*	-	+
9. Lesser Whitethroat *Sylvia curruca*	-	-
TURNIDAE		
1. Bluethroat *Erithacus svecicus*	-	-
2. Pied Bushchat *Saxicola caprata*	-	-
3. Stonechat *S. torquata*	-	+
MOTACILLIDAE		
1. Paddyfield Pipit *Anthus novaeseelandiae*	+	+
2. Tawny Pipit *A. campestris*	-	+
3. Grey Wagtail *Motacilla cinerea*	-	-
4. White Wagtail *M. alba*	-	-
5. Large Pied Wagtail *M. maderaspatensis*	-	-

PLOCEIDAE			
1. Baya *Ploceus philippinus*	-		-
2. Yellowthroated Sparrow *Passer xanthocollis*	-		-
3. Whitethroated Munia *Lonchura malabarica*	-		+
4. Spotted Munia *L. punctulata*	-		-
FRINGILLIDAE			
1. Rosefinch *Carpodacus erythrinus*	-		-
TOTAL	85	14	43



SOME OBSERVATIONS ON THE FEEDING AND BREEDING BIOLOGY OF OPENBILL STORKS *ANASTOMUS OSCITANS* IN ANDHRA PRADESH

MERAB JOHNSON, V. NAGULU & J.V. RAMANA RAO

ABSTRACT

Openbill Stork *Anastomus oscitans*, belonging to the Order Ciconiiformes, is a local migratory species widely distributed in Andhra Pradesh. During August 1987 to October 1989, observations were made at Kolleru and Puniakshethram.

Kolleru in Krishna District is the largest fresh-water lake in India with a variety of fauna and flora. The lake has an area of 901km^2 at +10 MSL and a normal water spread area of 346km^2 at +5 MSL and lies between longitudes 81°5'E to 81°20'E and latitudes 16°32'N to 16°51'N. It was declared as a bird sanctuary in 1972. During the months of December 1987 to May 1988, more than 8,000 pairs of Openbill Storks were observed at Kolleru. Their main diet consists of freshwater snails *Pita virlens* that are available in abundance in the lake area. The lake is losing its ecological identity because of various man-made activities. The disturbance factors will be discussed.

Puniakshethram village (*c.* 17°N, 81°51'E) near Rajahmundry in East Godavari District, is a breeding site for these birds. 650 nests were observed on 11 Wood Apple *Feronia elephantum*, 5 Tamarind *Tamarindus indus* and 11 Palmyra Palms *Borassus flabellifer* during August to October 1987. In 1988, 567 nests were noted on 10 Wood Apple, 1 Tamarind and 39 Palmyra palms while in 1989, 396 nests were seen on 8 Wood Apple and 38 Palmyra palms. Tamarind trees were cut down, thus forcing the storks to nest on the available Palmyra vegetation. The nests were circular with a mean diameter of 45cm (n=5) and a depth of 16.5cms. The average clutch size was 3 (n=5). Activity of birds was recorded randomly at these nests. Conservation measures will be discussed herein.

INTRODUCTION

Out of the 17 species of storks belonging to 11 genera, the Asian Openbill Stork is most abundant and widely distributed throughout Asia, though threatened in parts of its range, particularly Southeast Asia (Luthin 1985).

STUDY AREAS AND METHODS

Field studies were conducted on *Anastomus oscitans* in Andhra Pradesh during the period August 1987 to October 1989, with emphasis on observations on the food and feeding behaviour at Kolleru Lake during the months of December to May.

Nesting aggregations of *A. oscitans* were observed at Puniakshethram near Rajahmundry, East Godavari District of Andhra Pradesh during June to November (Figure 1).

50cm quadrats were laid in different habitat types to asses the vegetation and the snail abundance which forms the main diet of the Openbill. At Puniakshethram, the storks use Wood Apple, Tamarind and Palmyra palms for nesting.

6 nests from the 3 tree species were randomly selected and marked for observations and the activity in these 18 nests was recorded. The population was determined by visual counting with the help of 7x50 binoculars. Photographic records were obtained on the behaviour of birds at nests. Temperature and humidity were recorded with a wall thermometer and hygrometer respectively. Measurements of the birds in different stages of development were with a measuring tape. The amount of time spent by the bird in various activities such at preening, roosting, feeding, wing spread, territorial fights and arranging nest material, were recorded with the help of a stop watch.

RESULTS AND DISCUSSION

Freshwater snails are found in abundance at Kolleru (Figure 4). *Pila virlens* forms the main diet of Openbill Storks. Assessment of the snail abundance in different habitats by the quadrat method indicated that the maximum number of snails were found in vegetative areas, especially in the *Ipomea aquatica* mats and to a lesser extent in dry fish ponds, open lake area and agricultural fields. The flock size of the stork population also varied similarly, with the maximum number of Openbills found feeding in the weeds and very few feeding in open water and agricultural areas.

We observed two methods of feeding on the *Pila* species.

1. The stork walks about irregularly probing into the vegetation till it obtains a *Pila* shell in the bill. It rolls the shell up and down the bill till the operculum is loosened. It then pulls out the mass and swallows it along with the operculum.
2. It stands still without any movement and waits for a snail to come out of the shell. It quickly cuts off the operculum near the foot portion and then

just pulls out and swallows the mass. The storks do not breed in the lake area due to lack of tree cover.

There are various disturbances factors like fishing, illegal encroachments converting the natural lake area into fish tanks and agricultural fields, grazing of livestock, human disturbance: for navigational and fishing purposes, motor boats and dugout canoes keep traversing to-and-fro causing a disturbance to the birds (Nagulu 1987). With the increase of fish tanks, more people have set up establishments on the lakebed to monitor the fish tanks throughout the year. Duck rearing is a major occupation of the local people. The snail mass forms part of the duck feed. Several locals collect heaps of these snails to feed their domestic ducks. Hence there is depletion of the main diet of the Openbills. Poaching is another disturbance factor (Rao, M. 1987).

By the end of May, the Openbill Storks disperse in flocks to various breeding sites. One such site is Puniakshethram village, which is about 107kms from Kolleru. In the village, these birds nest on Wood Apple, Tamarind and Palmyra palms. Being colonial nesters, Openbills are highly active socially in their breeding colonies. Nesting success in relation to the population is shown in Figure 3. The males establish themselves at suitable nest sites. Initially when the females approach the lone males, they are driven off after violent exchanges but they return again and are eventually accepted. Both the male and the female share the responsibility of nest building, incubating the eggs and rearing the young.

For copulating the male gets on to the back of the female and bends legs to lower body for cloacal contact. The female sits in the nest with the neck bent completely backwards so that the bill is pointing upwards. The male shakes head vigorously thus hitting the bill of the female with his bill. Coition varied from 8 to 14 seconds. The average clutch size is 3 (n=4). The nest is circular with a diameter of 45cm and depth of 16.5cm, made of loose dry twigs that are spirally arranged.

PARENTAL BEHAVIOUR

From egg laying stages onwards the parent birds do not leave the nest together simultaneously. When one goes for feeding, the other stays behind in the nest either incubating the eggs or arranging nest material or cleaning the nest by pecking at and throwing out dried fecal matter, thus protecting the eggs from predators like crows *Corvus* spp., and kites *Milvus* spp. The altricial young are wholly dependent on parents for feeding throughout their presence in the breeding area. Even the fully winged fledglings were fed by parents despite their self-feeding. Both sexes take part in sharing the responsibility in raising

the young. The newly hatched are brooded closely. The slightest movement of the chicks is sufficient to indicate to the parent to change its position.

The adult bird spreads out its wings wide, standing on the nest, protecting the chicks from the harsh heat. This protective shielding attitude is observed more at noon (at an average of 24 seconds), when the sun is directly overhead, and is normally not seen in cloudy weather. The adults shade their young from the sun either by raising their wings or by standing over them. This frequency decreases, as the chicks grow older. The spread-wing postures may have other functions like wing drying, thermoregulation i.e., cooling or warming, feather treatment, balancing and social displays (Kahl 1971b). Both parents deliver food at regular intervals. The adult bird regurgitates food into the nest from where the chicks feed (Kahl 1971a). The frequency of food delivery depends mostly upon the age of the young. The youngest of the chicks often receives brutal pecks from the older ones. This is generally observed during feeding, when the youngest is just pushed aside and if lucky, may manage to get a little of the food. An interesting observation was that even when the nest was destroyed due to cyclone, the stork regurgitated the food on to the naked branch itself, wherein most of the food fell to the ground from where it was readily eaten up by the eagerly waiting crows and the chick was hardly able to get a few morsels. While delivering food, the adult stands and regurgitates the food into the middle of the nest, from where the young swallow it. During the nestling stage, the bird at the nest site is relieved regularly at fixed intervals. As soon as one of the adults returns, it greets its partner by the crossing of necks while uttering a series of hollow, slightly nasal, "honking" sounds - "*huuu, huuu, huuu*" (Kahl 1972). Then it settles itself in the nest while the other of the pair takes off. It then starts feeding the young. When the young are capable of moving i.e., 35-40 days, the adults no longer remain at the nest but visit regularly to deliver food.

NEST SANITATION

The Openbill Stork cleans its nest regularly thus preventing insects and parasites from breeding; young storks squirt liquid feces over the edge of the nest. Parent storks attempt to remove desiccated fecal matter by using the saw-like edge of the upper mandible. The loosened pellets were later tossed out of the nest.

PREDATION AND MORTALITY

Human interference is the main cause for the loss of eggs. As intruders approach a nesting tree, the birds take off suddenly, as a result of which the

nest gets dislodged, which may result in the breakage of eggs. When the nests are deserted due to disturbance, crows and kites are attracted and the uncovered eggs or newly hatched altricial chicks are under threat from these predators. The number of crows was more during egg laying and hatching stage and decreased once the young grew older. No feathered young were seen being attacked by predators. During the fledgling period (September-October) rate of mortality is about 60% when compared to that of nestling and sub-adult stages. Chicks fall off the nest due to lack of space and are orphaned. Such dislodged chicks finally die of starvation. The parent does not feed the chick on the ground. But an interesting observation of instinctive behaviour was made when in a natural calamity due to a cyclone in October 1987, a tree was uprooted and all the nests and inhabitants were grounded. The adult birds were seen to feed the chicks on the ground too. This behaviour is significantly different from the normal behaviour.

BREEDING SUCCESS

Breeding success is completely based on natural selection. The present study revels that deaths were due to competition among siblings for food and space, and influence of external physical factors like temperature and rainfall. The success of breeding also depends upon abundance of food, suitable nesting trees and the breeding site being free from human disturbance, predators and natural calamities like gales, cyclone and floods.

CONSERVATION MEASURES

At Kolleru, it is essential to conserve the Openbill Storks only by means of fencing certain areas widely used by them where large flocks of these birds are observed (Anjaneyulu 1988). This could help against the entry of disturbance factors like livestock, boat movements, and human disturbance. At the breeding site, conservation measures could include the appointment of a forest guard to watch the birds and see that the nests are not disturbed by the locals, and to create public awareness by placing appropriate boards on the main road so that people are informed that Puniakshethram is a breeding site for the Openbill Storks.

ACKNOWLEDGEMENTS

Financial support from the Sálim Ali Loke Wan Tho Ornithological Research Fund of the Bombay Natural History Society is gratefully acknowledged. We

thank the Andhra Pradesh Forest Department and the Kolleru Lake Development for all the help rendered.

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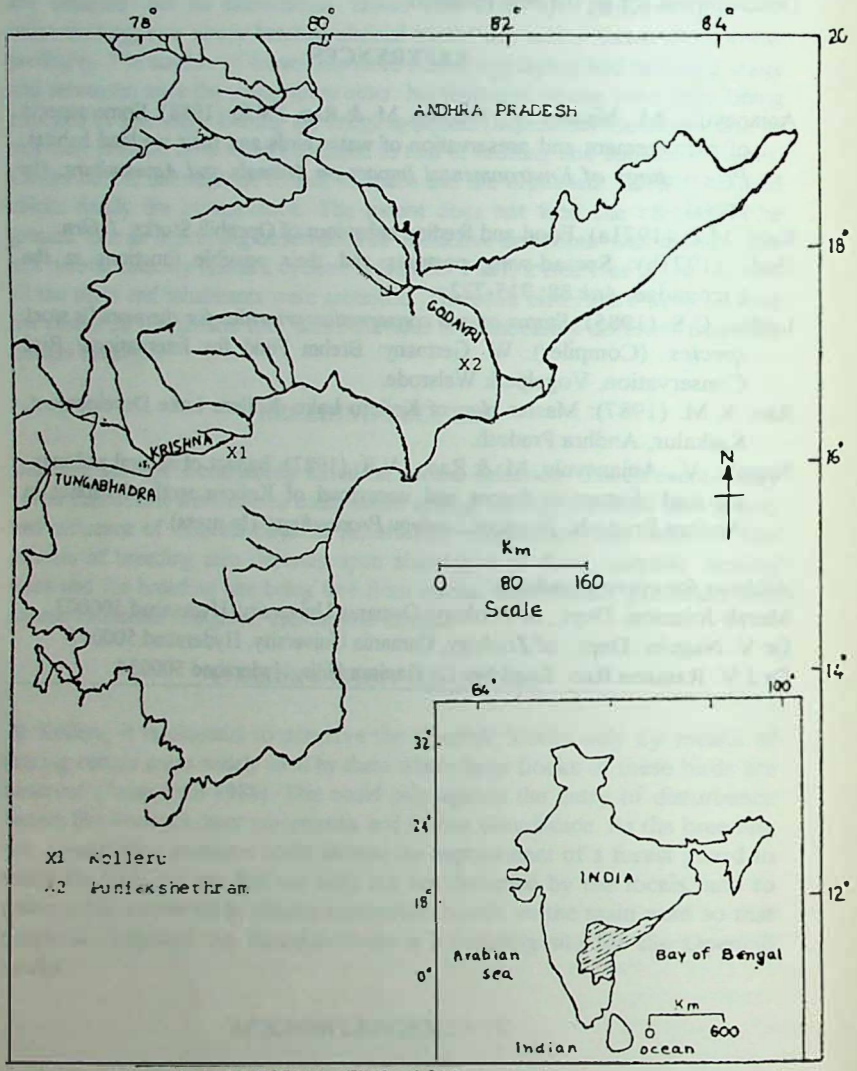
FIGURE 1



MAP DEPICTING STUDY AREAS

FIGURE 2

Habitat types at Puniakshethram

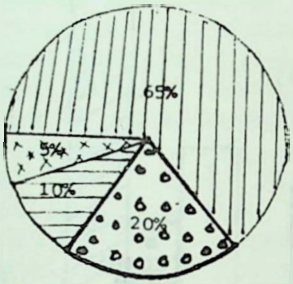


Fig. 2

→ Agricultural area

→ Grassland

→ Herbs and Shrubs

→ Tree Cover

FIGURE 3

Yearwise Nesting success of openbill storks at Puniakshethram in relation to population.

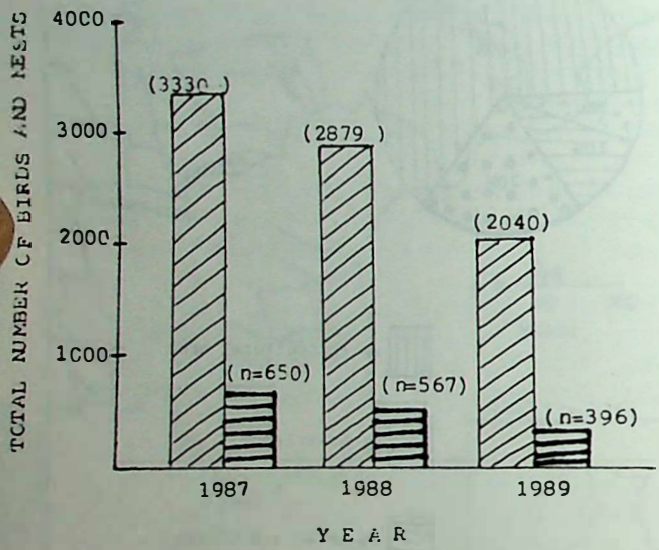


Fig. 3

FIGURE 4

ABUNDANCE OF SNAIL SPECIES
AT KOLLERU DURING MARCH, 1988

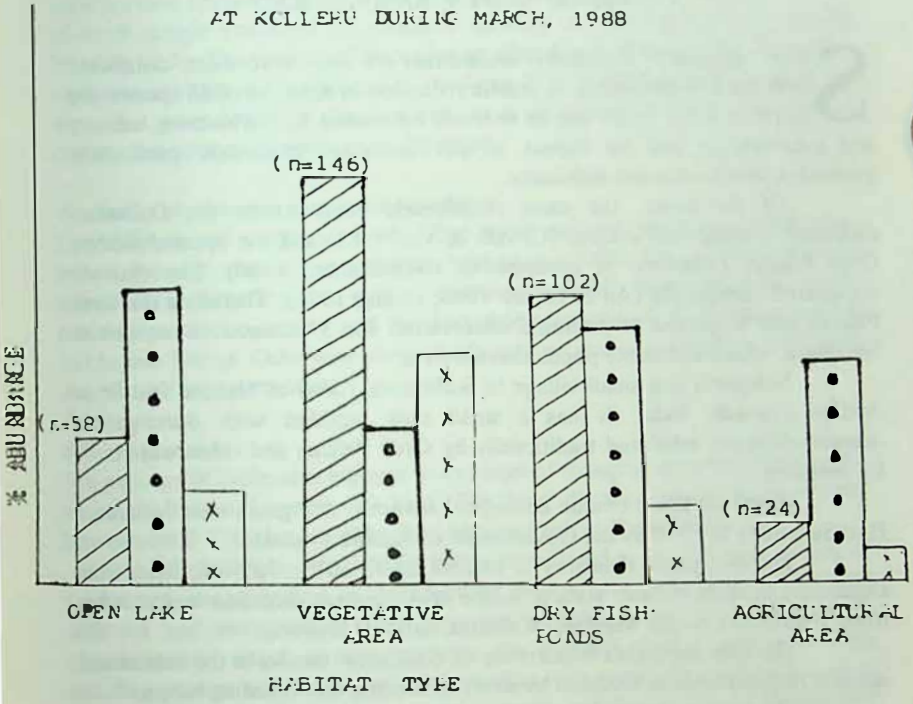


Fig. 4

→ Pila virlens

→ Lymnea species

→ Endoplanorbis species.

THE GREY PELICAN AT NELAPATTU

V. NAGULU AND J.V. RAMANA RAO

Seven[1] species of Pelicans (Pelecanidae) are known to exist, distributed over the five continents. A drastic reduction in numbers of all species, the world over, is noted due to in-roads on habitat by agriculture, industry and urbanization and by impact of environmental chemicals, particularly pesticides, weedicides and defoliants.

Of the seven, the most threatened seems to be the Dalmatian *Pelecanus philippensis crispus* (Crivelli & Vizi 1981) and the Spottedbilled or Grey Pelican *Pelecanus p. philippensis* (Neelakantan 1980). The two are considered conspecific (Ali & Ripley 1968; Cheng 1976). Therefore the Grey Pelican was subjected to scientific observation for 3 consecutive seasons at Nelapattu, where a sizeable population survives.

Nelapattu is a small village in Sullurupet *Taluq* of Nellore District in Andhra Pradesh, India. It has a small tank studded with *Barringtonia acutangula* trees, inhabited traditionally by Grey Pelican and other waterbirds for breeding.

Based on these unique ecological features, this place was declared a Bird Sanctuary in 1976 by the Government of Andhra Pradesh.

The Nelapattu Pelicanry is located at 13°50'N, 79°59'E, 2km from Doravari Chattram railway station, in the north-eastern direction and is 90km from Madras city on the Madras—Calcutta, national highway.

The data highlights importance of ecological factors in the habitat and survival requirements as revealed by study of feeding and breeding habits.

The factors that govern the success of the sanctuary and survival of Grey Pelican are five-fold. Nesting space, nesting material, proximity of water as insulating medium, fishing grounds and protection from human activity including pollution.

Nesting space

There are about 141 *Barringtonia acutangula* trees, located in the middle of the tank. The tank receives its full water during northeast monsoon during October/November every year. Thus, the naked trunks are fully submerged under water and only top canopy can be seen above the waters.

This situation attracts quite a number of waterbirds for breeding. Notable among these are Grey Pelicans, Openbilled Storks *Anastomus oscitans*, White Ibis *Threskiornis melanocephalus*, etc.

Nesting Material

The total area covered by the bird sanctuary is about 1,134 acres. Of these, 204 acres are tank spread and the rest is covered with scrub jungle. This vast stretch of scrub jungle provides the required quantity of nesting material for the breeding birds. The tank itself provides an abundance of water reed *Pasendoraphis aspera* that is mainly used by the Grey Pelican for the inner lining of the nest. This grass lining of the nest acts as a good heat insulator and also as cushion that prevents breakage of the eggs.

Proximity of water as insulating medium

Grey Pelicans are gregarious birds. They roost and nest on trees as other tree-nesting Pelicans, the Brown and Pink-backed, do. Each year the Grey Pelicans return to this breeding site only if the trees are fully surrounded by water, ensuring protection, safety and freedom from disturbance from other animals and human beings. Otherwise they overfly and so journey elsewhere until such time the water accumulates.

Fishing grounds

The pelicans of Nelapattu enjoy a wide range of foraging grounds all along the length of Pulicat Lagoon (59 km). The long distance travel is by soaring between 0900-1500 hours. They feed both in fresh and brackish water.

Pulicat Lagoon (c. 46,000 ha) is considered to be the chief source of food during the early part of the breeding season, when the lake gets flooded with sea and river water. This situation promotes rapid multiplication of organic matter, which in turn increases the population of a variety of biota including prawns and mugils, which coincides with commencement of breeding season. The prawns and mugils were brought and fed to the newly hatched young. An inventory has been made of the dietary of Grey Pelican at Nelapattu. Pearson (1967) stated that the breeding of sea birds coincides with the period of greatest abundance of the Ammodylidae and Glupeidae in the area and he quotes the examples cited by Marshall (1951), Lack (1954) and Salomonsen (1955).

Protection from human activity including pollution

Old men of Nelapattu village recall their grandfathers saying that the pelicans had always bred in the area and venerate the birds and object to any one who interferes with their habits and habitat and resent poaching. These sentiments still continue. At present there is no pollution of any kind that affects the visiting birds but the area needs to be kept under surveillance for any future inadvertence.

BREEDING SUCCESS

The success of breeding depends upon abundance of food, suitable nesting trees and absence at breeding site of predators and natural calamities like gales, cyclones, floods, or human disturbance.

Nelapattu is free from the factors mentioned above and fully satisfies all the needs of the nesting birds. Breeding success during the study period was 73.5% and the mortality was 26.5% despite uprooting of a few trees in the cyclone of 1982.

MORTALITY

Mortality includes egg loss and the death of the young. The reason for egg loss is human interference. When a person approaches a nesting tree the birds take off suddenly and as a result dislocation of nests occurs leading to slipping of eggs and their breakage in the process. Some times when nests are deserted due to disturbance, crows *Corvus* are attracted and the uncovered egg or newly hatched altricial young are under threat from the crow or Brahminy kite *Haliastur indus*. The number of crows was more during egg laying and hatching and decreased once the young grew up.

Mortality of young through predators is considerably less. Crows and Brahminy kites attack the young when they are naked and fleshy-red during the absence of adult from the nest. No feathered young were seen being attacked either by Brahminy Kites or Marsh Harriers *Circus aeruginosus*, who were regular visitors. Reptiles did not pose a threat here.

Since nesting trees are located in the midst of water, the eggs and young are left untouched by mammalian predators even when the trees were uncovered by water. Jackals *Canis aureus* move around the sanctuary during night and village dogs during day, but no damage by them is noticed.

Even prior to its declaration as a sanctuary, poachers were kept away by villagers who used to protect this area by employing watchers. Intruders were caught and punished severely.

TEMPERATURE

Temperature had a significant influence over the young birds. Those waiting to leave the nest were mostly seen to die due to a sudden rise in temperature, when the tank was dry. This is evident from the study of past three years that the deaths occurred at the last leg of the summer season.

CONSERVATION METHODS

Of the features of the general habitat at Nelapattu, as the preceding point reveals, water, as an insulating medium, is most important. The neighbouring scrub jungle provides ample nesting material. An urgent point seems to be the need for increasing nesting sites, all the more as the recent cyclones have leveled or broken many trees. It is essential to experiment with tree transplantation. The Barringtonia being a slow growing tree, it may be necessary to select from far-off well-grown trees to attempt transplantation at the required spot. Finally, dislodged eggs or young may be tended in incubators. By these means it should be possible to increase prospects for survival of the Grey Pelican at Nelapattu.

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[1] Editor's Note: The Dalmatian Pelican *Pelecanus crispus* (earlier a subspecies of *P. philippensis*), is now treated as a full species by most Taxonomists. Thus making 8 species in the Pelecanidae family.

BREEDING SUCCESS AMONG HOUSE SPARROW *PASSER DOMEASTICUS* AND INDIAN RING DOVE *STREPTOPELIA DECAOCTO*, TWO SPECIES INHABITING AN ARID ENVIRONMENT

B.D. RANA & NISHA KASHYAP

ABSTRACT

In case of House Sparrow *Passer domesticus* highest percentage of eggs (89.82%) hatched and 83.8% nestlings of the total eggs laid during monsoon fledged, whereas, during spring 81.8% and in summer only 49.1% fledged. Similarly, 72.7% and 24.6% fledglings left the nest during spring and summer seasons respectively. No significant difference was found between spring and monsoon hatching periods. Significant difference ($P<0.01$) was observed between hatching success of spring and summer and between summer and monsoon. An over all breeding success was accounted for 69.5% of the total eggs laid during breeding season.

Of 32 eggs laid by the Indian Ring Dove *Streptopelia decaocto* during spring only 31.2% hatched and a low percentage of nestlings fledged, 15.6% of total eggs laid. The nesting success during the monsoon period was higher. Of 77 eggs laid, 44% hatched and a comparatively large number (39.0%) fledged. The nestling success between the two breeding periods was not significantly different [$X(1)=3.15$, $X(1)\ 0.05=3.84$].

The House Sparrow and the Indian Ring Dove are abundant birds of the Rajasthan desert. This study was carried out at Central Arid Research Institute, Jodhpur, Rajasthan. The following grass species grow abundantly on the sandy plain at the farm—*Eleusine compressa, Cenchrus biflorus, C. ciliaris, C. setigerus, Panicum antidotale, P. turgidum, Brachiaria ramosa* and *Dichanthium annulatum*. Herbs are represented by *Tephrosia purpurea, Heliotropium strigossum, Boerhavia diffusa, Indigofera cordifolia* and *Capparis decidua* and trees by *Prosopis cineraria, Acacia tortilis, A. senegal, Azadirachta indica* and *Albizia lebbeck*. Crops of millet and pulses are also grown at the Central Research Farm.

MATERIAL AND METHODS

Regular field observations of the nests, number and dates of egg laying, hatching period, breeding potentiality and growth of the nestlings were recorded.

RESULTS

Breeding Behaviour

Nesting Site: *Passer domesticus indicus* usually prefer building their nests in the crevices of thatched roofs of old houses, on electric pipelines in ventilations and in the space between walls and electric meters. Most of the nests are simple, flat and situated at a height of 1.5m.

Ring Doves prefer to build nests on trees like *Prosopis cineraria, Acacia tortilis* and *A. senegal*, and in hedges of *Inga dulcis*. The simple flat nest is usually situated at a height of 1.5m to 2.7m on the branches, similar to the nest height of the Turtle Dove *Streptopelia turtur*, in England. The nest of *S. decaocto* is usually in the middle of the tree where the tree's top branches conceal it. The selection of almost similar nest heights by *S. turtur* in England and by *S. decaocto* in India probably indicates parallel evolutionary trends in these two species.

Nest Composition: It was observed that House Sparrows usually lay eggs in freshly constructed nests. Thin parts of *Brachiaria ramosa, Aristida funiculata, Cynodon dactylon, Cyperus rotundus* and *Azadirachta indica* are used as nesting materials.

Most doves lay eggs in freshly built nests but some birds renovate old ones. The male Ring Dove plays an important role in collecting nest building material, like twigs, mainly from *Zizyphus nummularia, Leptadenia pyrotechnica, Tephrosia purpurea* and *Calotropis procera*. Thin grasses like *Eleusine compressa* and *Aristida* sp., wool of sheep, and sometimes its own feathers are used for lining the nests. Sheep wool was found only in one out of about 54 nests examined. This particular nest was near an experimental sheep pen. Although doves were not actually seen taking the wool, the neat arrangement of the wool fibers in a cluster under the eggs clearly indicated that the birds used the wool as nesting material.

Clutching Period: The first House Sparrow egg was laid on 10 February 1985. Table I, indicates that there are two peak seasons of egg laying. One in

March (21.2%) and the second in August-September (14.8%) in an arid zone environment.

The first Ring Dove egg was found on 4 April 1970. The monthly clutch distribution shows that the Ring Dove has two distinct breeding peaks, i.e., one in April (22%) and the second in August (24.7%) and September (38.5%) (Table II).

Clutch Size: The House Sparrow's clutch size ranged from 2 to 6 (average 3.59). The frequency of 2 to 3 clutches was found to be more all through the breeding season. The larger clutches were laid during March, April and August to October. House Sparrows laid low numbers of clutches during May and June months (Table I).

The Ring Dove's clutch size varied from 1 to 3 (average 1.84). The frequency of two eggs per clutch is 78% (Table II), whereas only two clutches of three eggs were recorded in September.

Incubation and nesting periods: The incubation period varied from 11 to 14 days (average 12.50, ±0.20 days). Female sparrows feed their nestlings till they leave nests. The nestling period was found to vary from 14 to 18 days (average 15.71, ±0.25 days).

In the case of doves, the incubation periods during spring and monsoon seasons differed significantly (P 0.01) from each other. The spring incubation period ranged from18-19 days (mean, 18.5, ±0.15); the monsoon period ranged from 10-17 days (13.3, ±0.57).

Female doves feed their nestlings until they leave the nest. The spring nestling period varies from 14-18 days (16.0, ±0.43). These differences were not significant.

Breeding Success: Among House Sparrows an over-all breeding success was accounted for 69.5% of the total eggs laid during breeding season. Highest percentage of eggs (89.8%) hatched and 83.8% nestlings of the total eggs laid during monsoon fledged, whereas; during spring 81.8% hatched only 49.1% hatched during summer. Similarly, 72.7% and 24.6% fledglings left the nest during spring and summer seasons respectively (Table III). No significant difference was found between spring and monsoon hatching periods. There was a significant difference (P 0.01) between hatching success of spring and summer and between summer and monsoon seasons.

Of 32 eggs laid by doves during spring only 31.2% hatched and a low percentage of nestlings fledged—15.6% of total eggs laid (Table IV). The nesting success during the monsoon period was higher. Of 77 eggs laid, 44%

hatched and a comparatively large number (39%) fledged. The nestling success between the two breeding periods was not significantly different [$x^2(1)$-3.15, $x^2(1)$ 0.05=3.84].

Egg-Predation: Maximum House Sparrow eggs (50.8%) were destroyed by predators during summer, as compared to monsoon (10.1%) and spring [(18.1%), Table III]. The total egg-loss was 20.1%. After hatching, total loss of nestlings was 10.3%. A large number of nestlings were destroyed during summer (24.6%) followed by spring (9%) and monsoon (5.9%) only.

The House Crow *Corvus splendens*, and the Indian Roller *Coracias benghalensis*, usually predated on Ring Dove eggs. Predatory birds destroyed about 68.7% of the eggs during spring and 55.8% during the monsoon (Table IV). Only three eggs out of 109 were infertile. These losses amount to 61.4% of the total eggs laid. After hatching 8.2% of the nestlings were lost to predatory birds.

Breeding Season: *Passer domesticus indicus* lay eggs from February to October under arid environment. The maximum egg-laying activity was observed during March and August-September, whereas, minimum during May-June. The percentage of eggs laid and ovulation in the ovary ranged from 2.1 to 21.2 and 55 to 80 respectively, during the year. The Ring Doves breeding season lasts from April to October.

DISCUSSION

Male and female *Passer domesticus* inhabiting Indian desert, exhibited sexual maturity at about equal body weights, as it is observed in the sparrows of other parts of the world (Lack 1954, Summers-Smith 1963, Seel 1968). The present study reveals that females start laying eggs relatively earlier as compared to temperate zones (Lowther 1983, Pinowski 1979).

In the western hemisphere, House Sparrows lay eggs throughout the year (Wagner 1950) at Mexico, Moresu (1950) and Dawson (1973) reported that House Sparrow lays eggs from October to January (90 days) in Zanzibar, Africa (Lat. 16°S) and from September to January (120 days) in New Zealand (Lat. 40°S) respectively, in the southern hemisphere.

Kumudanathan *et al.* (1983) observed that House Sparrows lay eggs all the year round, at Hyderabad (Lat. 78°28'N), Andhra Pradesh, India, whereas Naik and Mistry (1973) stated that sparrows breed from February to October (about 245 days) at Baroda (Lat. 22°10'N), Gujarat, India. The present study reveals that *Passer domesticus indicus* lay their eggs from 10th

February to October (263 days) at Jodhpur (Lat. 26°18'N), arid zone. The larger breeding season of *P. d. indicus* at Jodhpur can be explained by the facts that sparrows built their nests inside buildings, which protects the nests from harsh climate and predators. Two peaks in egg-laying activity one during spring and during monsoon season are well coincided with the availability of green food in abundance during these periods in the Indian desert.

A clutch of *P. domesticus* is reported from 3 to 4 eggs (av. 4.3) at Baroda, Gujarat (Naik & Mistry 1973) and it is 2 to 5 eggs (av. 3.96) at Hyderabad, Andhra Pradesh (Kumudanathan, *et. al.* 1983). In Jodhpur population, it ranged from 2 to 6 (av. 3.59). Likewise, Summers-Smith (1963) and Seel (1968) observed a clutch size of 2 to 8 (av. 4.1 and 3.9) respectively in England (Lat. 51°40'N).

The Ring Doves' breeding season lasts from April to October, as evidenced by its testis weight, rate of ovulation, and actual egg-laying, the presence of sperm in male birds, seasonal fluctuations, *etc.* Two distinct peaks are evident in the birds' egg-laying activities, the first peak in the spring and the other during the monsoon. During both seasons, green food is comparatively abundant in the desert, much more during the monsoon, when a significantly [$x^2(1)=22.9$, P 0.001] higher rate of egg laying is manifested. The hatching success and survival of young birds is also of a higher order, after the monsoon breeding peak. Such a dependence for the maintenance of maximum breeding response to green pastures has also been reported for the Wood Pigeon in London (Baker 1938, Lack 1950, Moreau 1950, Murton & Issacson 1962, Murton *et. at.* 1963, Lofts *et. al.* 1966).

SUMMARY

House Sparrows prefer to build their nests at a height of 1.5m in the crevices of roofs in residential buildings, electric pipelines and even in electric meters.

The clutch size varied from 2 to 6 (mean 3.59). The mean incubation and nestling periods were 12.5 ± 0.20 days and 15.71 ± 0.25 days respectively.

The House Sparrows lay eggs from February to October. The two peaks in egg-laying activity were observed during March and August-September periods, corresponding to green food availability during these months in the Indian desert.

Ring Doves prefer to build their nests at a height of 1.5m to 2.7m on trees like *Prosopis cineraria*, *Acacia tortilis*, *A. senegal*, and hedges of *Inga dulcis* spp. The simple flat nest is usually made up of thin grasses and small tree twigs.

The egg weight ranged from 5.9g to 8.6g (av., 7.5g). The clutch size varied from one to three (av., 1.84). Of the total eggs laid 69.6% were destroyed by predatory birds. The eggs laid in monsoon season were significantly larger (P 0.01) than those laid during spring. The average incubation and nestling period were 15.9 and 15 days respectively.

The Ring Dove breeds from March to October as evidenced by seasonal fluctuations in testes weights, percentage of adult fecund males, rate of ovulation and egg-laying. The two peaks in egg laying correspond to the spring and monsoon periods when green forage is available.

ACKNOWLEDGEMENTS

We are deeply grateful to Dr J. Venkateswarlu, Director, Central Arid Zone Research Institute, Jodhpur, for providing facilities and encouragement. We are also thankful to Shri Shankar Lal Banjara, Tech. Assistant (T-1) for helping us in recording the field observations.

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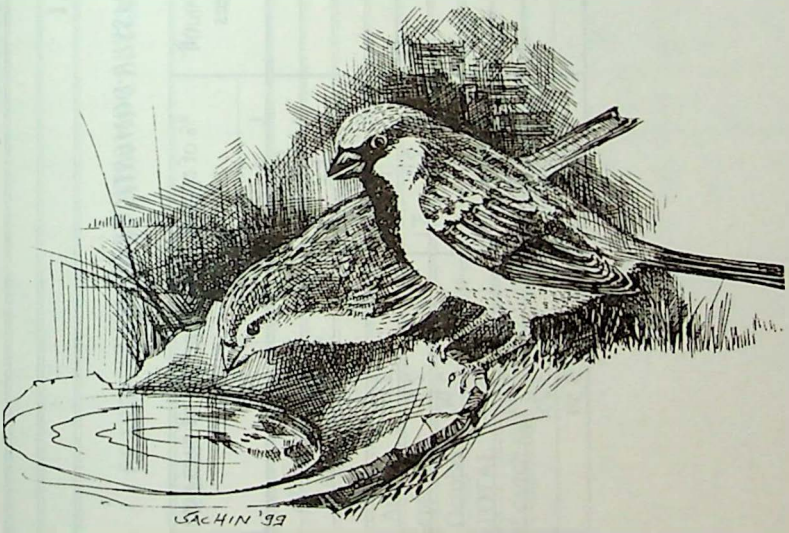

TABLE I

DISTRIBUTION OF CLUTCHES IN *PASSER DOMESTICUS INDICUS*

Months	Frequency of occurrence of clutches Clutch Size					Total No. of clutches	% of eggs	Average No. of eggs per clutch
	2	3	4	5	6			
February	-	5	-	3	-	8	8.5	3.75
March	3	5	6	4	2	20	21.2	3.85
April	2	3	4	2	1	12	12.7	3.75
May	1	2	-	-	-	3	3.1	2.66
June	1	1	-	-	-	2	2.1	2.50
July	3	4	2	-	-	9	9.5	2.90
August	2	5	4	2	1	14	14.8	3.64
September	4	3	3	2	2	14	14.8	3.64
October	2	4	2	3	1	12	12.7	3.75
TOTAL	18	32	21	16	7	94	99.4	3.59

TABLE II

SEASONAL DISTRIBUTION OF CLUTCH SIZE IN RING DOVE *STREPTOPELIA DECAOCTO*

Months	Clutch size			Total number of clutch	Percentage of eggs	Average number of eggs per clutch
	1	2	3			
April	2	11	-	13	22.0	1.84
May	2	3	-	5	7.3	1.60
July	1	2	-	3	4.5	1.66
August	3	12	-	15	24.7	1.80
September	2	17	2	21	38.5	2.00
October	1	1	-	2	2.7	1.50
TOTAL	11	46	2	59	99.7	-
% of clutch size	18.7	78.0	3.3	-	-	-

TABLE III

BREEDING SUCCESS IN *PASSER DOMESTICUS INDICUS*

Seasons	No. of eggs laid	% of eggs hatched	% of eggs destroyed	% of nestlings destroyed	% fledged
Spring (Feb-March)	110	81.8 (n=90)	18.1 (n=20)	9.0 (n=10)	72.7 (n=80)
Summer (Apr-Jun)	61	49.1 (n=30)	50.8 (n=31)	24.6(n=15)	24.6 (n=15)
Monsoon (Jul-Oct)	164	89.82 (n=150)	10.1 (n=17)	5.9 (n=10)	83.8 (n=140)

TABLE IV

BREEDING SUCCESS OF RING DOVE *STREPTOPELIA DECAOCTO*

Seasons	No. of eggs laid	% of eggs hatched	% of eggs destroyed	% of nestlings destroyed	% fledged
Summer	32	31.2 (n=10)[1]	68.7 (n=22)	15.6 (n=5)	15.6 (n=5)
Monsoon	77	44.1 (n=34)	55.8 (n=43)	5.5 (n=4)	39.0 (n=30)

[1] Figures in parentheses indicate the actual numbers.

ROLE OF BIRDS IN BALANCED ECOSYSTEMS OF ARID AND SEMI-ARID BIOTOPES OF THE DESERT

INDRA KUMAR SHARMA

ABSTRACT

Birds play a major ecological role in arid and semi-arid biotope ecosystems. Dispersal of seeds of trees, shrubs and herbs is significantly performed by frugivorous birds e.g. bulbuls (Pycnonotidae), mynas (Sturnidae), Rosy Pastor *Sturnus roseus* (migratory), Coppersmith *Megalaima haemacephala*, *etc.* Seedivorous birds consume high percentage of seeds produced by grasses and herbs that considerably reduce over congestion of grasses and herbs at biotopes. Purple Sunbird *Nectarinia asiatica*, myna, bulbuls, *etc.*, play a vital role in pollination of flowers of several species of trees and shrubs; worthy of mention are *Tecomella undulate*, *Prosopis cineraria*, *Capperfsaphyla*, *Calotropis procera*, *etc.* Insectivorous birds play a vital role in control of population booms of several insects; serious pests to trees and plants particularly termites, moths and hoppers. Scavenging birds play a vital role in consuming garbage and carcasses of animals, thus helping in maintaining sanitation, e.g., vultures (Falconidae), Scavenger Vulture *Neophron percnopterus*, Starling *Sturnus vulgaris* (migratory), mynas, Grey Partridge *Francolinus pondicerianus*, Jungle Crow *Corvus macrorhynchos*, *etc.* Birds of prey considerably control excessive growth of rodents, birds and reptiles.

The role of birds in the ecosystem of the Thar Desert has been little studied, Sharma (1983, 1985). Various roles of birds, in ecosystems of Thar Desert, were studied from 1981 to 1989 in Jodhpur division, Rajasthan, and are presented here.

METHODOLOGY

Various typical biotopes of Thar Desert were selected to study roles of birds in these biotopes. The study was performed from February 1981 to December 1989 in Jodhpur division, western Rajasthan, Thar Desert. 7x50 power binocular was used to observe birds, activities from a distance without disturbing by close approach.

OBSERVATIONS AND DISCUSSION

Role of birds in pollination of flowers

Pollination of flowers is very important for formation of seeds for continuance and dispersal of trees, shrubs and climbers. In addition to insects, birds also play vital role in it. The Purple Sunbird *Nectarinia asiatica* pollinates flowers of *Tecomella undulata, Prosopis cineraria, Acacia* spp., *Cocculus* spp., *Capparis decidua, Calotropis procera, etc.* Common Myna *Acridotheres tristis* and Rosy Pastor also play role of pollination of flowers of *Tecomella*. Bulbuls *Pycnonotus cafer* and *P. leucogenys* and Yellowthroated Sparrow *Petronia xanthocollis* were observed pollinating flowers of *Capparis* and bulbuls those of *Calotropis*.

Role of birds in dispersal of seeds

Dispersal of seeds by birds and animals is important part of ecosystems. Bulbuls were observed playing significant role in dispersal of seeds of *Zizyphus nummularia, Salvadora* sp., *Maytenus emarginatus, Capparis, etc.* The Roseringed Parakeet *Psittacula krameri* inhabits groves, agricultural farms and villages and plays a vital role in dispersal of seeds of *Acacia* spp., *Prosopis juliflora, P. cineraria, Maytenus, Salvadora, etc.* The Grey Partridge *Francolinus pondicerianus* also plays notable role in dispersal of seeds of *Salvadora, Maytenus, Acacia, Prosopis, Capparis, Zizyphus* and *Lycium barbarum*.

Role of birds in reduction of over congestion of seeds in an area

Grasses produce very large number of seeds that cause over congestion of seeds to germinate. Seedivorous birds consume excessive number of seeds at the ground, which reduces over congestion and unhealthy competition among germinating seeds for space and nutrition. Reduction of over congestion of grasses also facilitates seeds of trees, climbers, shrubs and herbs to grow. Seedivorous birds in arid and semi-arid region of Thar Desert are Little Brown *Streptopelia senegalensis* and Ring Dove *S. decaocto*, Blackbellied Finch-Lark *Eremopterix grisea*, Whitethroated Munia *Lonchura malabarica*. Several species of winter migratory larks and to a considerable extend the Grey Partridge and Sandgrouse *Pterocles exustus* also consume seeds.

Control of insect population

Insects multiply rapidly particularly in the rainy season and in spring, if there are no biological controllers, plant pest insects play havoc on vegetation cover. Insectivorous birds play vital role in ecosystems to control excessive growth of

populations of rapidly multiplying insects. Important insectivorous birds in the region are bulbuls, Indian Robin *Saxicoloides fulicata*, babblers *Turdoides* spp., Black Drongo *Dicrurus macrocercus*, Grey Shrike *Lanius excubitor*, Small Green Bee-eater *Merops orientalis*, Hoopoe *Upupa epops*, Chat *Saxicola* spp., (winter migrant) and Grey Partridge. Birds control excessive growth of spiders, which flourish much in desert.

Birds of prey

Birds of prey play a vital role in the control of excessive growth of rodents particularly Indian Desert Gerbille *Merriones hurrianae* and Indian Gerbille *Tatera indica*, seedivorous birds, lizards and snakes, so also large insects and arthropods including scorpions. Birds of prey which are fairly common and play vital role in desert ecosystems are Blackwinged Kite *Elanus caeruleus*, Shikra *Accipiter badius*, Short-toed Eagle *Circaetus gallicus*, Tawny Eagle *Aquila rapax*, Pallas's Eagle *Haliaetus leucorhyphus*, Desert Buzzard *Buteo buteo*, Falcons (Falconidae), and owls of the following species *Bubo bubo, Asio otus, Tyto alba, Athene brama, etc.*

Scavenging birds

Carcasses of animals, on putrefaction, cause serious health problems. Several birds play vital scavenger role in ecosystems of Thar Desert. Whitebacked Vulture *Gyps bengalensis*, Longbilled Vulture *G. indicus*, Griffon Vulture *G. fulvus*, Scavenger Vulture *Neophron percnopterus*, Jungle Crow *Corvus macrorhynchos* and Raven *C. corax* readily consume carcasses and prevent putrefaction of carcasses.

Jungle Crow, babblers, Grey Partridge, *etc.*, consume dung of herbivore mammals.[1] Jungle crow, raven, grey partridge, Cattle Egret *Bubulcus ibis*, mynas and Starling consume decaying organic materials and prove useful scavengers.

Pest-control at agricultural farms and agro-ecosystems

Widespread agriculture is practiced around oases and in other places in the rainy season in the Thar Desert. Hence at agricultural farms, for success of agricultural crop, birds play vital role in such agro-ecosystems. The grey partridge, bulbuls, Indian robin, babblers, Little Egret *Egretta garzetta*, hoopoe, black drongo, mynas and wagtails (Motacillidae) and starlings (migratory) play vital role in control of insect pests. It was observed that agricultural farms rich with bird fauna have comparatively little insect pest problems.

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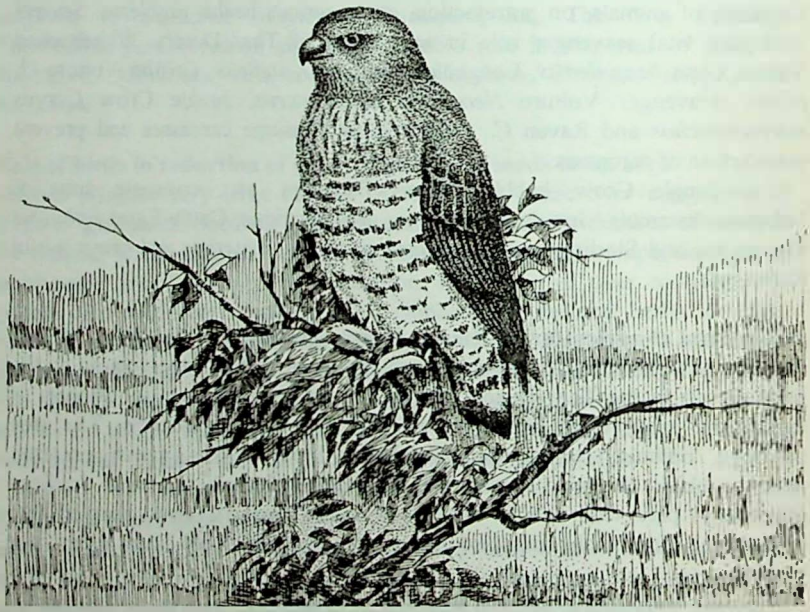
[1] Editor's Note: These birds may be pecking at undigested seeds that have passed out of a herbivore's digestive system and remained in its dung.



SOME DISTRIBUTION PATTERNS OF INDIAN BIRDS AND THEIR RELEVANCE TO BIOGEOGRAPHY AND SYSTEMATICS

KUMAR GHORPADÉ

ABSTRACT[1]

A background of the sequence of historical events pertaining to the Greater Indian Plate (now peninsular India) is presented, before analysing some distribution patterns of Indian birds. Biogeography is explained as = physical features (geology) → climate → Vegetation → animal life history (dispersal and vicariance). The three principal biogeographic divisions of our subcontinent are 1) The Himalaya, 2) The Indo-Gangetic Plains, and 3) The Peninsula. Besides exhibiting an ecological "vacuum" before colliding with the Eurasian land mass with its northeast edge in the Paleocene/Eocene (50-70 million years ago) and completing its northwestern link in the Miocene (75 million years ago) and resulting in the Himalayan uplift, it is postulated that the shift to a monsoon climate, drying up and draining of the Indo-Brahm marshes, and, especially, the creation of the Deccan Trap (now a plateau) and the 4-5 glacials and interglacials (pluvials) in the Pleistocene (1-2 million years ago) were major geological and climatological events that affected the floration and faunation of the subcontinent.

Through a series of distribution maps, the invading bird elements from the Eremian (NOT tropical African!), Turkmenian, Indochinese and Indomalayan regions are identified. The peculiar bird relics of the Indo-Gangetic plains, the Western Ghats and the Eastern Ghats are highlighted, along with some other puzzling distribution patterns. The evidence for use of the Eastern Ghats/Coast pathway by the majority of bird colonisers from the Indo-Chinese and Indo-Malayan regions as against their use of the Satpura highway is discussed.

Biogeographical evidence and data use is emphasized in the study of bird systematics and the current dangerous and inappropriate trend of highlighting the subspecies category is criticized. Finally it is regretted that the genus category as presently defined and used plays no part in information retrieval and so needs to be revised on a world scale.

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[1] Editor's Note: Full paper was not received till the date of publication.

NESTING OF BLACKBACKED WOODPECKER *CHRYSOCOLAPTES FESTIVUS* AROUND BANGALORE EXAMPLES OF (A) SYMBIOSIS, (B) COMPETITORS

S. SRIDHAR & R S. HARAVE

ABSTRACT[1]

Observations on nesting of two pairs of Blackbacked Woodpeckers *Chrysocolaptes festivus* were made near Bangalore and at Sira, 150kms north of Bangalore during the breeding season of 1989. The first pair nested on a Coconut tree *Cocus nucifera*, in a prime coconut farm of about three acres, 15km southwest of Bangalore. The crown of this particular coconut tree had wilted. There were eleven nest holes in a row made by Blackbacked Woodpeckers during the previous seasons. Most of them were occupied by breeding pairs of Roseringed Parakeets *Psittacula krameri* and a pair of Common Mynas *Acridotheres tristis*. During a three-hour observation period, Roseringed Parakeets were found to approach and inspect, either singly or in pairs, the woodpecker nest as a prospective nesting site on seven occasions.

The woodpeckers were in a way benefited by the parakeets, as the parakeets were seen collectively attacking and warding off predators like Rat Snake *Ptyas mucosus*, which was observed climbing the coconut tree on one occasion. The woodpecker which was instrumental in providing several nest holes to the parakeets on the same tree derived the benefit of protection from predators like snakes. In this particular case the woodpeckers were successful in raising a male fledgling.

The other pair of Blackbacked Woodpeckers had excavated a nest hole on an *Acacia* sp., tree, near Sira where the terrain is open and sparsely wooded. Here, the woodpecker pair was observed to be under constant threat from secondary hole-nesters—Indian Roller *Coracias benghalensis*, Roseringed Parakeet and Common Myna. In a four-hour observation period the Roller pair attacked and tried to appropriate the nest of the woodpeckers on ten occasions. A pair of Roseringed Parakeets was also seen prospecting the nest hole five times and the Common Myna pair once. As the nesting of secondary hole-nesters coincided with the primary hole-nesters (woodpeckers), and also due to non-availability of suitable trees in this open, sparsely wooded country, there was intense competition for nesting sites.

The primary hole-nesters like woodpeckers and barbets (Capitonidae) nest in fairly large numbers around Bangalore and in the evergreen wet tropical

forest of Karnataka, where secondary hole-nesters also nest, but without fierce competition. But around Sira, for paucity of suitable nest sites, the primary hole-nesters are under competitive pressure and expend much energy and time in defending their nests, with nesting success at considerable risk.

[1] Editor's Note: Full paper was not received till the date of publication.

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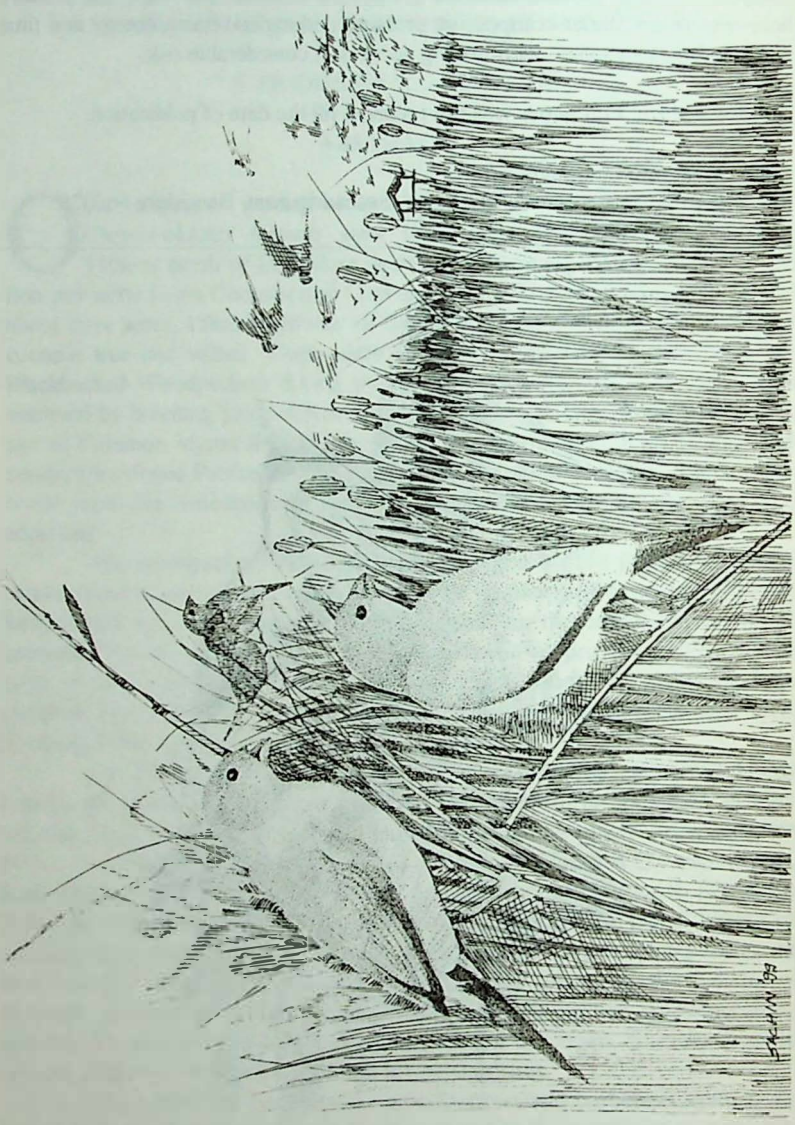
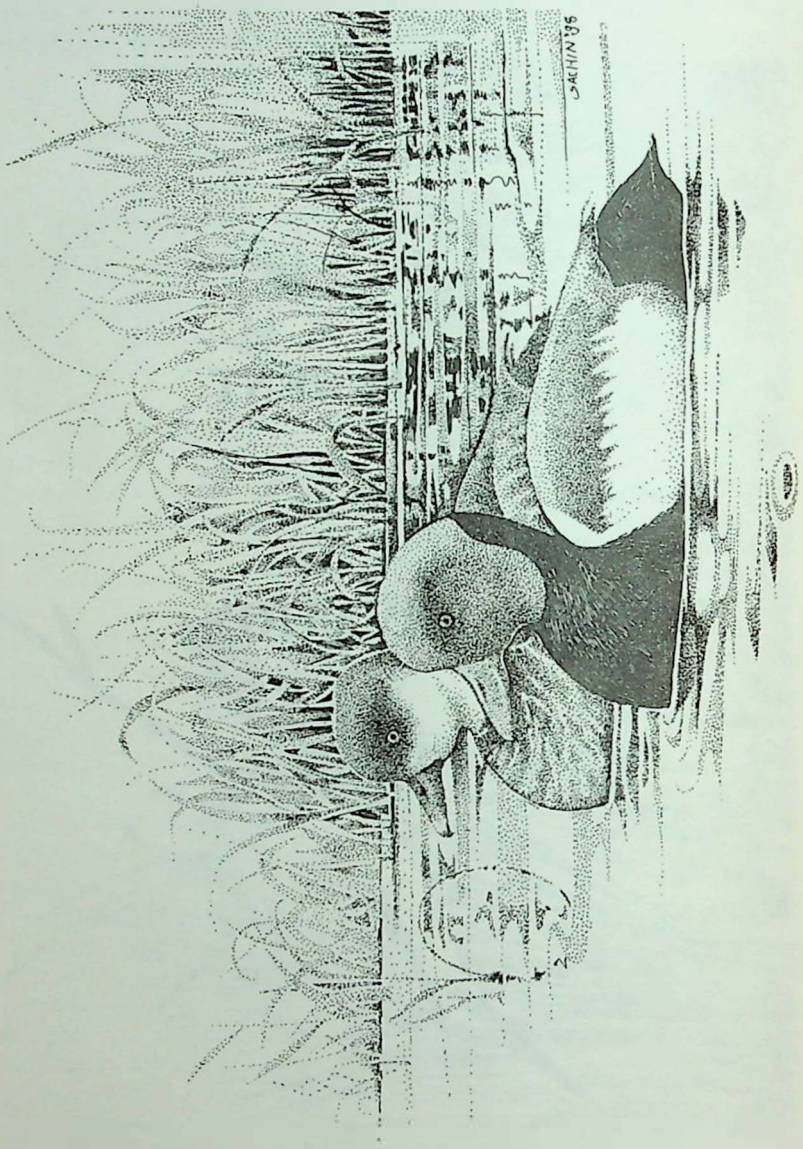


IV

DEVELOPMENT

AND

CONSERVATION


SACHIN '95

WETLANDS AND WATERFOWL—ASPECTS OF DEVELOPMENT

S.A. HUSSAIN

ABSTRACT

Just under 100 species of shore and wading birds belonging to ten families occur in the Indian subcontinent and adjacent oceanic islands, of which roughly 46 percent are resident and the rest migrant. The breeding population of north and central Asia wading-birds move southwards into the Indian subcontinent, and commence their fall migration by mid-August reaching a peak in late October.

Wetlands of Kashmir Valley and the Indo-Gangetic Plains provide a broad spectrum of dispersal ground for some of the shore and wading birds adapted to feed in freshwater conditions. Most migrants spread out along the eastern and western coasts of the peninsula, including the islands of Sri Lanka, Andaman and Nicobar group.

India has a vast coastline stretching over 3,600km with sandy shores, mangrove backwaters, lagoons, mudflats, estuaries and large brackish/saline lakes adjoining the coast. The peninsular landmass is flanked by the Arabian Sea in the west and the Bay of Bengal in the east. The major coastal wetlands which attract larger number of wading and shore birds are the Gulf of Kutch, Vedaranyam estuary in the southeast, Pulicat Lake and Chilka Lake in the southern tip, the Gulf of Mannar and adjacent coast on the peninsula, as well as the island of Sri Lanka, have a constant shift of shore bird populations. While most of the shore birds range over the coast and several thousand water-bodies throughout the country, there are at least two major estuarine wetlands that host large concentrations of shore birds. These are Chilka Lake in the state of Orissa and Great Vedaranyam Estuary in Tamil Nadu.

Two major wetlands in India, Bharatpur and Chilka Lake have already been designated as Ramsar sites. While Bharatpur has considerable protection, much remains to be done at Chilka Lake. However, the Orissa state government has now implemented all the recommendations for conservation, made by the Bombay Natural History Society, and plans to fund long term research studies.

Three major factors that threaten the wetlands of India and their birds are drainage and land reclamation for agriculture; pollution from waste disposal; and in fresh water wetlands, siltation and the spread of exotic weeds such as water hyacinth. Coastal mangrove forests are under great pressure from land reclamation, industrial effluents, and from cutting for firewood. The huge

demand for domestic firewood has resulted in large-scale destruction of mangroves around Bombay (Mumbai) in Maharashtra, Point Calimere and Pitchavaram in Tamil Nadu, Sunderbans in West Bengal and around Jamnagar in Gujarat.

One of the very important functions that wetlands perform is to provide suitable habitat for breeding for resident birds as well as wintering ground for short and long distance migratory water birds. Since migration is essential for the survival of the species, availability of suitable habitats, both on migratory route as feeding/moulting areas as well as on the final destination as wintering sites, is critical to these migratory waterfowl.

In recent years, most "natural" wetlands the world over, have suffered drastically due to the impact of man's activities such as drainage, pollution, habitat alteration, and industrialization—leaving behind only small fractions of once pristine ecosystems. On the other hand vast tracts of man-modified habitats, particularly large wetlands, more due to accident than design, seem to attract both resident and migratory waterfowl.

RAMSAR SITES IN INDIA

One of the important obligations under the Ramsar Convention is to ensure the protection and proper management of wetland sites of international importance for migratory waterfowl, recognizing that waterfowl in their seasonal migration transcend national frontiers and so should be regarded as an international resource. This aspect is also covered by the Bonn Convention on migratory species, which deals with all animal species including waterfowl. India is a signatory to both these Conventions and is expected to fulfil its obligations under them.

Of the six Ramsar sites of international importance designated by India, Keoladeo National Park has been documented in great detail recently, while some detailed information on Chilka Lake is available, though recent data is lacking. Harike is a man-made reservoir (with a recent history) for which very little or no baseline data are available. Some information on the basic limnological studies is available on Wular Lake, Sambar Lake and Logtak Lake but sufficient data on waterfowl is not available.

WATERFOWL

Of the over 2,094 forms (species and subspecies) of birds occurring in the Indian subcontinent, nearly 344 are migrants, mostly from the northern

Eurasian region. During the northern summer months, between May and July, these birds breed in an area ranging roughly from the northern reaches of the Himalayas to Arctic tundra and from the Altai mountains in the west to Kamchatka province in the east. At the onset of the northern winter, around July-August, these birds migrate to Southern Hemisphere in an arc ranging from West Africa to Southeast Asia and Asia-Pacific, including Australia and New Zealand.

Studies carried out by various agencies in Europe, Russia and Asia over the years have revealed the magnitude and significance this colossal bi-annual migration as well as the importance of the migratory flyways and critical habitat requirement for migrating birds. Recent field studies carried out by the Russian biologists in the north and scientists of the Bombay Natural History Society in India have revealed some important aspects of migration and habitat requirement of the birds in the Indian subcontinent.

A BNHS project entitled "Study on the movement and population structure of Indian avifauna" (Avifauna Project), established two major field stations—Point Calimere Wildlife Sanctuary in Tamil Nadu and Keoladeo National Park in Rajasthan, where apart from carrying out bird banding activities, baseline data on plant/insect phenology, estuarine benthos and weather was collected. Satellite field study stations were also established at Harike Lake in Punjab, Pulicat Lake in Andhra Pradesh, Gulf of Mannar, Chilka Lake in Orissa and Khachch in Gujarat.

The study helped to evaluate the role of certain key wetlands in the subcontinent as important wintering/passage sites for migrating waterfowl. These studies have so far revealed significant information on certain aspects of the migration strategies of birds in the subcontinent as well as the role and current status of selected wetlands and forest areas and their importance to local and migratory birds. During the course of the study, disturbances and threats to major bird habitats were identified and recommendations were made for mitigating measures for the same.

A short appraisal of some major Indian wetlands and their significance as flyway ecosystems migratory and resident waterfowl as well as threat faced by them is made here.

FLYWAY WETLAND ECOSYSTEMS

1. Keoladeo National Park, Bharatpur, Rajasthan

Habitat: The Keoladeo National Park (*c.* 29,000ha) is a natural depression, which is inundated in years of good rainfall. Numerous bunds and roads criss-cross the park's open marshlands, dividing the entire area into several water-

logged compartments. Water flow within these compartments is regulated by strategically placed sluice gates. The sanctuary is fed, apart from rain, by water drawn from a large irrigation reservoir, the Ajan Bund, situated about 200m west of the boundary wall of the sanctuary.

Flora: The forest type is described as Tropical and Northern Dry Deciduous forest predominated by *Acacia* sp. Some of the other prominent species are *Zizyphus jujuba*, *Mitragyna parvifolia*, *Salvadora oleioides*, *Capparis* sp., and *Syzigium* sp. The aquatic regime is predominated by *Cyperus* sp., and *Typha* sp.

Avifauna: Over 225 species of birds have been recorded from the park. Amongst them Anatidae is represented by Pintail *Anas acuta*, Common teal *A. crecca*, Shoveller *A. clypeata*, and Garganey *A. querquedula*. Some of the uncommon Anatids are the Greylag Goose *Anser anser*, Formosa Teal *A. formosa* and Falcated Teal *A. falcata*. Amongst the Charadriidae, Marsh Sandpiper *Tringa glareola* is predominant followed by Ruff *Philomachus pugnax* and Temminck's Stint *Calidris temminckii*. Among the 151 species of forest birds, Blackthroated Weaverbird *Ploceus benghalensis*, Yellowthroated Sparrow *Petronia xanthocollis*, Brahminy Myna *Sturnus pagodarum* and Lesser Whitethroat *Sylvia curruca* are common.

2. Gulf of Manner, Tamil Nadu

Habitat: Mandapam (9°17'N, 79°8'E) lies on a narrow strip of land with Mannar to the south and Palk Strait to the north. The inshore region of the Palk Strait is mostly muddy while, in the Gulf of Mannar, it is rocky with small areas of sand and mud in between. At distances ranging from 5-8km from the mainland, the Gulf of Mannar has a chain of islands running roughly parallel to the coast. These islands are mainly of coral origin, probably of the nature of fringing reefs. However, the islands do not form a continuous stretch. The water in between these islands and the mainland is shallower than on the seaward side. Mangrove vegetation (*Rhizopora* sp., *Avicennia* sp., and *Exocaria* sp.) is predominant in these islands.

Avifauna: About 86 species of aquatic birds have been recorded from the wetlands around the Gulf of Mannar. Among the waders, Lesser Sand Plover *Charadrius mongolus*, Curlew-Sandpiper *Calidris ferruginea* and the Little Stint *C. minuta* are the most abundant species. The habitat is basically sandy and the sand-flat preferring waders such as Sanderling *Calidris alba*, Knot *C. canutus*, Eastern Knot *C. tenuirostris*, Bartailed Godwit *Limosa lapponica*, Curlew *Numenius arquata*, Whimbrel *N. phaeopus*, Turnstone *Arenaria interpres*, Large Sand Plover *Charadrius leschenaultii* and Grey Plover *Pluvialis squatarola* are commonly seen in hundreds. The other interesting

wader species recorded in the inter-tidal habitats in the Manali and Hare Islands, usually in flocks of several hundreds, are the Crab Plover *Dromas ardeola*, and the Oystercatcher *Haematopus ostralegus* in small numbers. The Lesser Crested Tern *Sterna bengalensis* and the Sandwich Tern *S. sandvicensis* are predominantly seen. The Greater Flamingo *Phoenicopterus ruber* regularly winters in Dhanushkodi and Pillaimadam Lagoons in thousands.

3. Pulicat Bird Sanctuary, Andhra Pradesh

Habitat: The wetland is situated in south coastal Andhra Pradesh (13°25'N–13°55'N to 80°03'E–80°19'E) on the eastern seaboard of India with an area of about 450km^2 thereby making it the second largest brackish water lagoon in India. The area was declared a bird sanctuary by the Andhra Pradesh forest department in the year 1976. The entire area is a vast brackish to saline lagoon with extensive mud- and sand-flats. The sanctuary is bounded on its eastern side by the spindle-shaped Sriharikota Island.

Sriharikota Island (185km^2) is of recent geological origin and is probably formed by recession of the sea. It is mostly flat with a few sand dunes ranging from 4.5m to 6m in height. The island is separated from the mainland by Pulicat Lake. It has extensive Tropical Dry Evergreen Forests interspersed with plantations of *Eucalyptus*, *Casuarina*, Cashew and numerous canebrakes besides several shallow water depressions.

Avifauna: The major residents of the Pulicat Bird Sanctuary are the Painted Stork *Mycteria leucocephala*, Spottedbilled Pelican *Pelecanus philippensis*, Grey Heron *Ardea cinerea* and Little Cormorant *Phalacrocorax niger*. The lake harbours two species of flamingos namely Greater Flamingo and Lesser Flamingo *Phoenicopterus minor*. Pulicat is also a major foraging area for the Spottedbilled Pelican and the Painted Stork. The former breeds at Nelapattu Sanctuary while the latter has a breeding colony at Vedurupattu village. Major duck species include Pintail, Shoveller, Common Teal and Garganey. Of these Pintails are the single largest duck species seen all over the sanctuary. Amongst waders, major populations are of Little Stint, Lesser Sand Plover, Kentish Plover *Charadrius alexandrinus*, Grey Plover and Ruff. Predominant gull species include Blackheaded *Larus ridibundus* and Brownheaded *L. brunnicephalus*. Whiskered Tern *Chlidonias hybrida*, Caspian Tern *Hydroprogne caspia* and Gullbilled Tern *Gelochelidon nilotica* are commonly seen in most parts of the sanctuary.

4. Kachch, Gujarat

Habitat: Kachch district, is bounded by the Great Rann on the northeast and southeast on the south by the Gulf of Kachch, on the west by the Arabian Sea

and on the northwest by the eastern branch of the Indus, which now lies in Pakistan. Its maximum length is about 260km from east to west, while its breadth is about 115km. Sandy plains and rocky hills with scrubby vegetation are the most prominent features of this district. Banni on the northern side of the Kachch mainland, 23°12'N, 69°54'E (*c.* 45,612km^2) is a low-lying alluvial plain (*c.* 840km^2), a major portion of which lies in Bhuj taluka. The Great Rann of Kachch forms the northern boundary of the Banni. It is one of the most extensive grasslands in India and gets inundated by the numerous rain-fed streams and *nullahs* flowing northwards into the Rann of Kachch (*c.* 22,400km^2).

Flora: The grassland, which is considered a part of the dry Rann, is characterized by extensive open areas interspersed with scattered stands of *Acacia nilotica*, *Calotropis procera*, *Capparis decidua*, *Salvadora persica*, *S. oleoides* and clumps of *Sueda fruticosa*, *Cressa cretica*, *Alhagi pseudoalhagi*, *etc.* A freshwater *jheel* (*c.*80km^2), locally known as Chhari Dhand, is a prominent feature of this grassland. Many smaller jheels dot the area (e.g. Servo, Loria). The *jheel* is bordered by stands of *Tamarisk* sp., *Salvadora persica* and *S. oleoides* interspersed by clumps of numerous herbs. This water-body is seasonal, filling up during years of heavy precipitation and through spillovers from the nearby irrigation reservoirs. A huge concentration of waterfowl is hosted by this Dhand during fall migration. During years of good rainfall the Banni becomes the wintering ground of enormous flocks of the Common Crane *Grus grus*, in the vicinity of the Dhand.

Avifauna: Little Stint, Temminck's Stint, Lesser Sand Plover, Kentish Plover, Coot *Fulica atra*, Common Teal, Shoveller, Fantail *Gallinago gallinago* and the Jack Snipe *Lymnocryptes minima* are some of the common waterbirds.

5. Harike Lake, Punjab

Habitat: Harike Lake, located 150km northwest of Chandigarh, is a man-made reservoir. The water has been impounded 7kms below the confluence of the Sutlej and Beas rivers and covers an area of about 40km^2. Its average depth varies from 1.2m to 4.2m. The lake is surrounded on its north eastern and southern sides by fertile agricultural land, on the west by the dam and headwork and on the north by the high mud-banks of the Sutlej. The two rivers flow in from an approximately northeast (Beas) and southeast (Sutlej) direction. Except along the main river channel the lake has a lush growth of submerged vegetation. Water Hyacinth *Eichhornia crassipes* covers most of the lake. There are about ten islands in the lake. Due to excessive siltation several sandbanks have become visible especially near the Harike headwork.

Avifauna: In Harike, over 110 species have been listed. Coots and Pochards (Common *Aythya ferina*, Tufted *A. fuligula*, and Redcrested *Netta rufina*) are the species commonly seen. Baer's Pochard *Aythya baeri*, Whitehead Stifftailed Duck *Oxyura leucocephala*, Scaup Duck *Aythya marila* are some of the uncommon species. Other waterbirds such as the Little Grebe *Podiceps ruficollis*, Large Cormorant *Phalacrocorax carbo*, Grey Heron, Purple Heron *Ardea purpurea*, Night Heron *Nycticorax nycticorax*, Glossy Ibis *Plegadis falcinellus*, Purple Moorhen *Porphyrio porphyrio* are also recorded.

6. Chilka Lake, Orissa

Habitat: Chilka, the largest brackish water lake in India, is situated on the East Coast of the Indian Peninsula in the state of Orissa (19°21'N – 19°54'N and 85°6'E – 85°33'E). With an area of approximately 1,100km^2 it is connected with the Bay of Bengal through a 29km long and 365m wide channel. While large flocks of birds scatter throughout the lake, the major concentration in terms of abundance is on a small island called Nalban, having an area of approximately 10km^2. Nalban is a shallow, reed covered marshy island, which remains completely waterlogged during winter and thereafter dries up in stages, providing feeding conditions for different species of birds. Thus, while in the beginning of the migration season, long-legged as well as dabbling species are abundant, small wading species congregate as the island dries up.

Avifauna: Chilka Lake hosts over 150 species of birds during peak migratory season. Less than one quarter of the recorded species are truly resident. The remaining being seasonal visitors. Small waders like Little Stint, Curlew-Sandpiper and Lesser Sand Plover are commonly seen. Little Tern *Sterna albifrons*, Gullbilled Tern *S. nilotica*, Blackwinged Stilt *Himantopus himantopus* and Collared Pratincole *Glareola maldivarum* are the breeding residents of the lake. Asian Dowitcher *Limnodromus semipalmatus* and Spoonbilled Sandpiper *Eurynorhynchus pygmaeus* are the rarest visitors to Chilka.

Recent studies have given some clues regarding the migratory routes; for example most of the wader species use the east coast to reach their breeding grounds. Species like Flamingo and some other waders wintering along the southeast coast enter India through west coast and use various freshwater habitats such as Bharatpur as staging sites during their spring passage. It is possible the west coast and north western part of India receive most of its precipitation through the southwest monsoon which generally extends from June to September corresponding with the autumn passage.

As southeast coast receives the rainfall mostly through the northeast monsoon which sets early October and prolongs to late January which corresponds with the wintering periods of the migrants.

Generally most of the freshwater bodies dry up during March and April (spring passage) and hence, migratory birds will not get any staging sites to reach the west coast. They seem to prefer the coastal habitat along the east coast to reach the breeding grounds. However there are not enough recoveries to substantiate this hypothesis.

Role of different wetlands as wintering, autumn, spring passage grounds for waterfowl is as follows:

Wetlands	Role
Point Calimere	Wintering and autumn passage.
Gulf of Mannar	Wintering, autumn and spring passage.
Kaliveli	Wintering site for freshwater species and spring passage for coastal spp.
Pulicat	Autumn and spring passage for waders, wintering site for waterfowl.
Chilka	Spring passage.
Khachch	Wintering and autumn passage.
Bharatpur	Passage and wintering site.

CONSERVATION ISSUES

Point Calimere, Tamil Nadu

Long term bird migration studies revealed that due to habitat alteration and loss of inter-tidal habitats there is a sharp decline in populations of some species such as the Greater Flamingo, Grey Plover, Ruff, Crab Plover, Turnstone and Avocet *Recurvirostra avosetta*. Some other species (Oystercatcher, Knot, Eastern Knot and Sanderling) which were seen in considerable numbers during the early eighties have become rare. During autumn passage in September and October most of the reservoirs of one of the chemical companies located in the swamp remain dry and the condensers become highly saline which forces the waders to abandon this area. In general the overall population of waterbirds wintering at Point Calimere has declined gradually. Moreover, the natural habitat is being encroached by the local villagers for converting them into salt pans.

In 1979, Tamil Nadu Industrial Salt Corporation (TIDCO), had planned to setup a salt-based industry in the Great Vedaranyam Swamp. During

that time, BNHS was entrusted to carry out a study of the impact of salt industry in the swamp. The government accepted the recommendations of the study (Ali 1981), and areas were earmarked to setup the industries without affecting the ecosystem. Similarly in 1988 when the Government wanted to have an Ammonium Chloride and Soda Ash factory in the swamp, it is understood the site was selected based on the earlier report (Ali 1981).

Bird migration studies in Point Calimere and Great Vedaranyam Swamp highlighted these areas as important sites for not only migratory waterfowl but also for fisheries. Hence, it was proposed in 1988 to add the swamp area (349km^2) into the Point Calimere Wildlife and Bird Sanctuary.

Gulf of Mannar

The inter-tidal habitats in Manali and Hare Islands, and the Dhanuskodi Lagoon are the ideal habitats for many waders, especially for the sand-flat preferring species. As such there is no threat to their habitats. The proposed Sethu-Canal project is expected to raise the sea water level by one metre and thus the available inter-tidal habitats will be submerged. This area was monitored for bird migration between 1985-88, before the area was declared as a Marine National Park.

It will be interesting to know the status of the migratory waders and other coastal birds after the declaration of the Marine National Park. Moreover most of the waders wintering here are the eastern species which generally winter in Southeast Asia and Australia. Hence, waders using the Australasian Flyway during their autumn and spring passages may occur in this habitat. Monitoring this crucial area will add further useful information on wader migration.

Chilka

Although Chilka was declared as a bird sanctuary in 1973 and subsequently a wetland of international importance under the Ramsar Convention, the avifauna is still greatly threatened due to several factors. The BNHS study recommended that Nalban Island be declared as a core area and fishing be prohibited in an 1km area around Nalban—which has been implemented.

The entire lake has been brought under the jurisdiction of the Wildlife Department for effective control. Presently Chilka is headed by an officer of DFO rank who is exclusively based at Chilka. The state wildlife department is monitoring the bird fauna of Chilka and a base camp has been set up at Parikud for this purpose. The authorities have fenced certain areas around Nalban which are potential bird habitats.

Khachch

The disturbance in the water regime of the area has led to an accumulation of dissolved salts, in the alluvial soil of the Banni grassland. Salt encrustation is now prominent in quite a few places in the Banni. The ingress of salinity in the locality has reached alarming proportions, with villages being deserted as the salinity creeps in over increasingly larger areas every year. Udma village has already been deserted, while the Rann has crept upto Dhordo in the last few years.

Previously the free flow of water through the grassland led to a regular flushing out of the accumulated salts. This has been disrupted now due to (a) the location of water harvesting schemes on streams flowing into the Banni, (b) the building of numerous roads and bunds through the Banni, which restrict and divert the flow of water from the normal channels leading into the numerous dhands which dot the area. The free flow of water, besides flushing out the accumulated salts, also led to a better retention of moisture in the soil for longer periods. This has been further aggravated, by the erratic rainfall in the area that leads to below optimum grass growth. This needs to be studied in detail.

Restoring the water regime of the area to its original undisturbed state may not be possible immediately. Nevertheless steps should be initiated to allot some of the water harvested in the area, to the downstream areas of the irrigation schemes, especially to the Banni grassland and the Dhand. A few water-harvesting schemes are in disuse in the vicinity of Fulay and Motichur villages.

CONCLUSION

Protection and conservation of major wetlands critically important to waterfowl in their traditional migratory flyways is the first priority. Most of these wetlands have essentially been natural ecosystems stabilized over the years and have retained their natural characteristics. In an ideal situation it would be most appropriate to maintain their natural process as far as possible, or at least restore/improve them if they are found degraded due to various reasons.

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INTEGRAL PLANNING OF CONSERVATION AND DEVELOPMENT PROJECTS

SIRAJ A. TAHER

ABSTRACT

India's wildlife has suffered progressive and accelerating destruction from the beginning of this century and this has assumed alarming proportions since the fifties. Developmental and other pressures continue to undermine the wilderness and any conservation action incurs people's antipathy or when rigidly enforced, even their hostility.

Wildlife conservation is linked with every facet of human existence and public support is influenced by several developmental activities, especially those that take place around wildlife reserves. In order that such developmental activity is compatible with the wildlife reserves, conservation activities in that region and the people, it is essential that an integrated and holistic approach be taken.

It is necessary to formulate a bold and pragmatic strategy for wildlife conservation—a combination of rigid discipline with reasonable alternatives where necessary.

PREAMBLE

In the next 3 years it is said that nearly $^{9}/_{10}{}^{th}$ of the Earth's inhabitants will be living in the developing countries, where the population is expected to double in the next 35 years. In developing countries, rapid growth of population has slowed down development by taking up a very large share of available resources to maintain the additional population. This in turn has often led to land degradation, desertification and poverty. The problem has been created by human over-exploitation of the land and its root cause is the growing imbalance between population size, resources, development and the environment. While easing population pressures is essential, any realistic effort to halt environmental degradation must address the problems of development and resource conservation, besides providing for basic human needs.

HOLISTIC APPROACH

Mounting pressures of abuse and over use brought in by population increases and the consequent deterioration of land productivity became the elements of a

vicious circle, which contributed progressively to environmental ravages. Devastating floods and crippling droughts have come to stay. It is ironical that while on one hand the green revolution and industrialization are preparing the country for economic advancement, widespread irrational use of land brings about environmental hazards and damage and negates all hope of sustained economic growth. It is clear that the welfare of forests, wildlife and forest-side communities is inextricably inter-woven. It is therefore necessary that a holistic and general approach is necessary to achieve a stability in which conservation and environmental protection are of primary concern.

REASONS FOR THE PRESENT SITUATION

There are 2 or 3 angles from which this problem can be looked into. From a public-concern point-of-view, one must consider the urban and rural people separately.

1. The urbanites, especially from the metropolitan cities do not experience the immediate impacts of both ecological instability and depletion of the wilderness or the benefits of a good environment. Thus the majority of the urban populace will be either indifferent or ignorant of the role of wildlife and it's habitats.
2. The rural people are the ones most vitally affected. A productive wilderness (or environment) has an enormous, direct and indirect advantage to them—abuse or over-use is responsible for it's degradation. Antagonistic reactions are normally encountered when enforcing the regulation. Political exploitation of such situations makes matters worse. Certain successful projects in some areas have shown that the rural public co-operation will be available if strict enforcement is backed up by reasonable alternatives. (Project Tiger, *etc.*)
3. A third viewpoint is looking at environmental concerns from the point of view of different interest groups. Politicians at the local level are more concerned with immediate problems and gains. Likewise, the development agencies both within and outside the government, concerned primarily with their sectors, e.g. power, irrigation, industry *etc.*, frown upon the restraints ordained by conservation and view these as impediments to the development process. This is because the not so apparent contributions of the wilderness are seldom taken into account when considering the direct gains of various development projects. This is the main reason why both the planners and the implementing agencies give very low priority to wildlife conservation.

4. The younger generation—both rural and urban—must be viewed as two different groups altogether. Their concern for wildlife is generally undeveloped because of lack of exposure and interpretation to its values and crucial significance. This adds to their indifference and contributes to the current widespread apathy.

Paucity of resources to provide inputs required to enhance the productivity of existing holdings, rapid population increases and the urge to provide relief to the people—all these combined to generate a permissive atmosphere that allowed expediency to dictate land use. Forests—already under pressure from industrial and commercial exploitation for timber, in addition, bear the increasing demands of firewood. This over-use ravaged the reserve forests and undermined the productivity of the remainder, turning vast areas into wilderness. Rapidly expanding economic activity took a further toll of areas under forest cover. Under the guise of crop protection, prey species of major predators were hunted down. Urban "*shikaris*" accentuated this depletion. Thus the wildlife of many areas suffered under a two-pronged attack—shrinkage of habitat and direct eliminative pressures. Weak legislative deterrents coupled with inadequate enforcement resulted in the utter failure to contend with this onslaught.

One other reason is that wildlife conservation schemes are not attractive to any state. This is because they result in considerable loss of forest revenue besides involving expenditure for the conservation project. It must also adopt anti-populist measures of village displacement for National Parks and Tiger Reserves, stopping grazing and collection of forest produce.

In India, various central and state ministries are responsible for separate sectoral activity under the overall guidance of the Planning Commission in accordance with national and regional priorities. For any developmental project the costs are viewed strictly in economical terms. There is no justification whatsoever for considering only the engineering merits or economics of such projects. Loss of forests and wildlife habitats, social and health costs, displacement and loss of earnings should feature in all such calculations of the cost-benefit ratio of the project.

EXAMPLES AND ALTERNATIVES

A) Hydel and irrigation projects consider only the engineering aspects of the dam, and canal network, and provide for command area development. Likewise flood control measures deal mainly with combating the problems

in flood prone areas. In both these areas emphasis should be on the development of catchment areas, as this will bring in long-term benefits.

B) Reckless expansion of agriculture on marginal land has led to widespread denudation, soil erosion and loss of soil fertility. '*Podu*' or 'shifting cultivation' has also contributed to this problem a great deal It is this colossal mismanagement of India's land resources, which is mainly responsible for the country's abysmal poverty

Some of the viable alternatives to the present state of mismanagement, which could be considered and tried in practice, are:

- Rationalizing land use
- Priority to soil conservation
- Afforestation programmes
- Development of pasture lands
- Effective enforcement
- Alternate energy sources

ANALYSIS

As mentioned earlier, because of the involved linkages of wildlife conservation with every facet of human existence, public life is crucially influenced by multifarious development activity, especially around wildlife reserves. In order that such development activity is compatible with conservation, an integrated and holistic approach is necessary. Public support and involvement in wildlife conservation can be forthcoming only if people accept the necessity of ecologically sound and sustainable development. Inadequate realization of the contribution of wilderness areas to material productivity increases threat to wildlife areas. Wildlife conservation suffers from paucity of resources without which effective field conservation action is not possible. Habitat destruction along with other decimating pressures like population increase, industrialization and hunting has brought the status of wildlife to it's lowest ebb ever. This has brought about adverse environmental repercussions.

SUGGESTIONS

1. Wildlife wings of State forest departments should first identify and define, on ecological and administrative considerations, the extent and location of individual wildlife reserves to be recognized as 'conservation zones' or 'eco-development areas'.

2. Before any development project is taken up, an environmental impact study (both on wildlife and the environment) should be made and suitable alternatives and adjustments suggested where necessary. The activities of various development agencies in such areas should be integrated with an eco-development plan. State forest departments should be involved with the district committees for coordinating rural development.
3. A central co-ordinating body like the Planning Commission should monitor the various development projects keeping in view the environmental angle before finalizing schemes.
4. Limit the use of timber exploitation from all natural forests except for tribals and forest inhabitants.
5. Forest revenues should be discouraged as a means of resource mobilization.
6. Judicious overall land-use—this alone will bring about welfare to the people of the area.
7. Soil conservation and environmental degradation costs in agricultural areas and catchment areas, as well as social costs, should be provided for in full in the total project cost of all irrigation and hydel projects.
8. Dependence of wood-based industries on the forest departments, for raw material supply should be discouraged. A progressively decreasing supply can be provided and the industry providing for the remainder from its own plantations on wastelands. The Government can identify these lands, and a well-formulated scheme of the State/Central Government can be strictly enforced in all such cases.
9. Large-scale plantations by forest development corporations should only be on depleted, degraded and denuded land and not after clear-felling of natural forests.
10. Legislatures, political and administrative executives, and planners should be aroused to the need to accept conservation and environmental protection as fundamental to their responsibilities. This can be done through legislature forums and orientation programmes.

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IMPACT OF URBANIZATION AND HUMAN PRESSURES ON THE SCRUB-JUNGLE BIRDS AROUND MADRAS

V. SANTHARAM

The vegetation of Madras, in the past, comprised primarily of the "tropical dry evergreen forest" of Champion & Seth (1968) or the *Albizzia amara* community of Meher-Homji (1973). This is the typical vegetation of parts of Deccan Plateau and along the Coromandel-Circar coastal areas in India. Popularly referred to as "scrub jungle", this vegetation type is found in areas where good and regular rains are absent in May-June. Physiognomically, this occurs as dense or discontinuous scrub-woodlands or thickets (Meher-Homji 1973, 1974).

Since the time Madras City was founded in the 1600's there has been a gradual decline in the natural vegetation which was cleared to make way for the expanding city and also for agricultural activities. The scrub was, and still is, cleared for meeting the fuel-wood demands and to raise monoculture plantations of *Eucalyptus*, Cashew, *Casuarina*, *etc*. Besides, it was degraded by heavy pressure inflicted by browsing and grazing livestock and in many places by quarrying.

Presently, the scrub jungles around Madras have been fragmented and reduced to small pockets on isolated hillocks. Housing colonies, industries, and agricultural lands and fallow fields surrounds them. Despite their legal status as reserved forests, these patches continue to get degraded and exploited. These patches range from as small as 40-odd ha, to less than 1,000ha in size.

Several studies have shown that fragmentation of a continuous habitat could have an adverse impact on its biota. Fragmentation leads to extinction of species, especially those that are habitat-specific or "specialists". As the habitat gets reduced in size and fragmented, each habitat patch can support fewer numbers (and species) of birds. The critical microhabitat may get destroyed for some species and in others, there may be a loss in the minimum required area or territory. There may be competition with birds from the newly created habitat around the fragmented patch, which might force some species out. Species with poor flying abilities cannot disperse to another patch and so there may be no re-colonization in areas where the species has recently become locally extinct. Species in fragmented patches may be susceptible to extinction due to predation by introduced species and pets and also by natural events such as cyclones. Besides, prolonged isolation may lead to in-breeding with its adverse consequences.

As there have been few substantial records in the past of the avifauna of the scrub jungles of Madras, it is a difficult task to assess the impact of urbanization and human pressures on bird-life. It is therefore only possible to compare bird-life of different sites, to find out the impact of human pressures. There was already one such study by Tara Gandhi (1986), which compared birds occurring in natural scrub and monoculture plantations. She found that natural scrub supported more birds as it was structurally more complex and was diverse in its resources.

I investigated the impact of habitat modification on the scrub-jungle birds. By habitat modification, I refer to those habitat patches where artificial planting of trees and shrubs (including exotics) has been done in the original scrub area and where the vegetation is being managed.

For my study, I chose seven sites of varying sizes, ranging from 45ha to 248ha, isolated from one another and within 30kms of the city. Three of these were modified sites and the rest, natural scrub jungles. I prepared checklists of birds of each site, excluding birds seen in overhead flight and aquatic species. I recorded a total of 88 species of birds from all the seven sites. I then classified the birds according to their status and habitat utilization. In the 'status' category, I had migrants, transients (species that were residents but did not breed within the site because of lack of nesting stratum) and the probable residents (species which could meet all their feeding and nesting requirements within the site). In the 'habitat utilization' category, I classified species as specialists (found usually in the sites and not in the urban gardens and parks) and non-specialists (found in a variety of habitats including urban gardens and parks). It may be noted that this classification is valid only for the areas around Madras where the study was conducted. Table I gives the species composition of the various sites.

TABLE 1: SPECIES COMPOSITION OF VARIOUS STUDY SITES

NAME OF SITE	TSP	PR	Tr	M	Sp.	NSp.
A. NATURAL SCRUB SITES						
Vandalur R.F.	55	26	16	13	15	11
Nanmangalam R.F.	30	15	10	5	8	7
Unamancheri R.F.	30	18	10	2	9	9
Perumbakkam R.F.	44	24	14	6	9	15
B. MODIFIED SITES						
Guindy N.P.	56	34	4	18	10	24
M.C.C. Campus	59	42	2	15	11	31
Theosophical Society	40	26	2	12	2	24

M=Migrant, M.C.C.=Madras Christian College, N.P.=National Park, Nsp=Non-specialist, PR=Probable Resident, R.F.=Reserved forest, Sp=Specialist, TR=Transient, TSP=Total Species.

***Note*:** For the 'habitat utilization' category, only probable residents are considered.

Analysis showed that the number of birds in a site depended on the number of microhabitats present therein such as trees, shrubs, open areas, grassy patches, *etc*. So a modified site had more probable residents as the introduced trees or cleared areas offered more strata to nesting birds. The modified sites had uniformly more migrants as compared to the natural scrub sites. There were more transients in the natural scrub sites, which perhaps indicate that these patches are feeding grounds for birds from adjacent habitats.

Looking at the habitat utilization pattern, it was found that the proportion of specialist species were consistently high in the natural scrub sites (37.5% to 57.6%) as against the modified sites (7.7% to 29.4%). Of the 24 resident specialist species, 22 were seen in the natural scrub sites and at least 11 of them were exclusively confined to it. As against this, the modified sites had 13 resident specialists and only 2 of them were exclusively found in these sites. Even these two species were seen in the scrub patches of the modified sites. A list of the resident specialists is appended. This shows the importance of natural scrub sites. Most birds in the modified sites used a wider range of habitats, as against the scrub jungle species, many of which were more habitat specific and depended on the scrub vegetation for their survival.

A closer look at three sites of more or less same area showed that there was a difference in their species composition. One of the sites (URF) had natural scrub, while another (MCC) had a mixture of both natural scrub as well as introduced trees and clearings and the third (TSE) had very little scrub and mostly had introduced trees and open areas. URF had 18 probable residents including 9 specialists, MCC had 42 including 11 specialists and TSE had 26 of which only 2 were specialists.

This illustrates how the species composition of a site changes with habitat modification and isolation. In a natural scrub area (URF) where the habitat is more uniform with little modification, there are more specialist species. As the habitat gets modified, retaining a part of the scrub intact (MCC), the additional habitats accommodate more species and there is an increase in the number of species (although, proportionately, the number of specialists is lower). Gradually, by human interference and natural causes (referred to earlier), the habitat loses its original nature (TSE) and the species composition gets altered retaining very few of the specialists. This, I feel, is

going to be the fate of all the scrub jungles (if they do not get converted into monoculture or housing colonies by then) around Madras.

Birds of scrub jungles represent the typical avifauna of the Madras region. Although they are not endemic to this region and not classified as endangered at present, it is essential to extend protection to them. Many of these specialist species may be present in small numbers and are patchily distributed as their habitat continues to get fragmented. It is possible that some of them may become locally extinct in the Madras area soon.

The scrub jungle is itself a unique vegetation type and is critically endangered. Satellite imagery has shown that less than 1% of the potential area has this vegetation. Scrub jungles are important from the floristic aspect as about 17.7% of its plant species are endemic to the drier eastern half of southern India (Meher-Homji 1974). Therefore, it is vital to protect the available scrub habitats before it is too late.

APPENDIX

RESIDENT SPECIALIST SPECIES IN THE STUDY SITES

SPECIES		N.S.	M.S.
HONEY BUZZARD	*Pernis ptilorhynchus*	+	+
WHITE-EYED BUZZARD	*Butastur teesa*	+	
SHORT-TOED EAGLE	*Circaetus gallicus*	+	
COMMON PEAFOWL	*Pavo cristatus*	+	
COMMON BUSTARD-QUAIL	*Turnix suscitator*	+	+
STONE CURLEW	*Burhinus oedicnemus*		+
RING DOVE	*Streptopelia decaocto*	+	
LITTLE BROWN DOVE	*S. senegalensis*	+	
GREENBILLED MALKOHA	*Phaenicophaeus viridirostris*		+
CROW-PHEASANT	*Centropus sinensis*	+	+
GREAT HORNED OWL	*Bubo bubo*	+	
BAYBACKED SHRIKE	*Lanius vittatus*	+	
GREYBACKED SHRIKE	*L. schach*	+	
COMMON WOOD-SHRIKE	*Tephrodornis pondicerianus*	+	+
SMALL MINIVET	*Pericrocotus cinnamomeus*	+	+
REDWHISKERED BULBUL	*Pycnonotus jocosus*	+	+
RUFOUSBELLIED BABBLER	*Dumetia hyperythra*	+	+
YELLOW-EYED BABBLER	*Chrysomma sinense*	+	+
COMMON BABBLER	*Turdoides caudatus*	+	

JUNGLE WREN-WARBLER	*Prinia sylvatica*	+	+
INDIAN ROBIN	*Saxicoloides fulicata*	+	+
PURPLE SUNBIRD	*Nectarinia asiatica*	+	+
YELLOW-THROATED SPARROW	*Petronia xanthocollis*	+	+
WHITE-THROATED MUNIA	*Lonchura malabarica*	+	

Note: "+" refers to the occurrence of the species, "N.S."=Natural Scrub, "M.S.=Modified Scrub.

ACKNOWLEDGMENTS

This paper is a part of my Thesis work submitted to the Salim Ali School of Ecology, Pondicherry, for the award of Masters degree in Ecology.

I thank Dr Priya Davidar who supervised this project and gave several suggestions and Prof. Meher-Homji for his kind encouragement and valuable references cited in this paper. I also thank the Tamil Nadu Forest Department for permitting me to study birds in their reserve forests, and at Guindy National Park and to the authorities of Theosophical Society and Madras Christian College for permitting me to visit their estates to conduct this study. I also thank several friends who helped me in this project.

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ECO- BIO-MANAGEMENT TO CONSERVE VANISHING BIRDS

INDRA KUMAR SHARMA

ABSTRACT

Amateur wildlife naturalists and conservationists have been mainly emphasizing the need to control poaching and the neglect of eco- bio-management for conservation of vanishing birds and other wildlife fauna. Besides poaching or indiscriminate hunting, loss of suitable habitats, breeding sites and excessive increase of vermin and robbers of nests and young are also major causes of decline of certain species of birds. Grass and scrubland have been widely and indiscriminately converted into agricultural lands which has adversely affected such biotopes as used particularly by Otididae, Phasianidae and Pteroclidae. Serious disturbances and modifications of wetlands have adversely affected survival of water birds. Birds require peculiar day rest and night roost and breeding nest sites; wide disturbances of such sites by man have affected bird health and breeding success, and ultimately their survival. Crows, dogs and cats grow in large populations around human habitations and rob nests and young birds in and around such sites and endanger survival of birds; hence population growth of vermin should be checked. Excessive use of pesticides by farmers has affected health and breeding of birds in and around agricultural farms. Hence for conservation of vanishing birds eco- bio-management in the region is necessary.

Aspects of necessary eco- bio-management for conservation of vanishing wildlife fauna, particularly birds, were studied in the Thar Desert of western Rajasthan from 1981 to 1989 in addition to earlier studies (Sharma 1983, 1984, 1985, 1989).

METHODOLOGY

Various typical biotopes and habitats of endangered birds were selected in Jodhpur division, western Rajasthan, to study how ecological, biological and human factors effect survival of vanishing birds and animals.

OBSERVATIONS AND DISCUSSION

Loss of suitable habitats

With rapid growth of human population and greed for exploitation of natural resources for more economic gains there is indiscriminate expansion of

agriculture and cattle herding in the Thar Desert region. This has effected natural habitats of wildlife fauna. As grassland and scrub are more suitable for agriculture and cattle herding such biotopes have been effected the worst.

On conversion of scrubland into agricultural land, fauna of the area is disturbed.

For conservation of endemic fauna at least 25% land of the area should be kept reserved for natural flora and fauna.

Loss of rest and roost sites

Birds require suitable rest sites to perch and for protection from sunlight, rain, *etc.*, so also for safety from predators. In agriculture most trees and shrubs are cut, thus destroying such perches as they offer, thereby disturbing birds.

For the wellbeing of birds, rest and roost sites should be properly cared for and managed.

Loss of vegetation cover safety

Ground birds use vegetation as cover against sunlight, storms and rains and more particularly to hide from predators and their easy assaults. On loss of suitable vegetation cover to agriculture and cattle herding the ground birds are worst hit. Particularly birds like the Grey Partridge *Francolinus pondicerianus*, sandgrouse (*Pterocles* sp.), Great Indian Bustard *Ardeotis nigriceps*, quails (*Coturnix* sp.), Houbara Bustard *Chlamydotis undulata* (migratory), Lesser Florican *Sypheotides indica*, *etc.*

Hence proper management of vegetation cover in an area is necessary for survival of birds of the region.

Loss of food

The modification of natural biotopes destroys the natural food-source of birds. On that these birds starve and perish or turn pest. Then repeatedly farmers attempt to annihilate these as pests.

Hence for conservation of birds enough at least 25% natural biotopes areas should be reserved for endemic birds of the region.

Loss of suitable and safe breeding sites

Birds require nest sites safe from natural adversities and predators. Conversion of land to agriculture leaves it devoid of such places. Thus driving away birds from the area.

Hence for survival of birds caring and managing for suitable nests sights ought to be.

RISE OF POPULATIONS OF SEMI-FERAL ANIMALS

The House Crow *Corvus splendens*, Pariah Kite *Milvus migrans*, domestic cats and stray dogs thrive around human habitations and agricultural farms. These animals and birds rob nests of birds, particularly ground birds, thus affecting their breeding success. The worst affected are the Grey Partridge *Francolinus pondicerianus*, Great Indian Bustard, Lesser Florican, Peafowl *Pavo cristatus*, *etc.*

For successful breeding of birds excessive growth of vermin animals should be checked around human habitation and farms.

Toxic effects of excessive use of pesticides

Excessive use of pesticides in agricultural farms kills insect pests and also poisons vegetation and soil cover. This effects food availability to insectivorous birds and causes the ill effects of toxification on birds. Because of rise of toxins in food, eggs of birds get defective, adversely effecting breeding success of birds.

Hence limited pesticides should be used discriminately only when and where necessary in agricultural.

Loss and modification of areas and gross human interference of wetlands

As demand of water in agriculture areas has increased much, man is now draining out the water from wetlands. This is causing serious problems for survival of wetlands birds. The worst hit are Barheaded Goose *Anser indicus*, Ruddy Shelduck *Tadorna ferruginea*, Gadwall *Anas strepera*, Pintail *Anas acuta*, Shoveller *A. clypeata*, Mallard *A. platyrhynchos*, Openbill Stork *Anastomus oscitans*, Blacknecked Stork *Ephippiorhynchos asiaticus* and Pheasant-tailed Jacana *Hydrophasianus chirurgus*. Hence at least 25% of water and 40% of area of wetlands should be reserved for endemic flora and fauna of wetlands without any human interference.

CONCLUSION AND RECOMMENDATIONS

With this study it is evident that because of gross indiscriminate interference of man in natural biotopes, birds are suffering from loss of suitable habitats, resting, roosting and breeding sites, from deficiency of edibles and from toxic effects of pesticides in agriculture farms. At least 25% of natural biotopes should be kept free from human interference, and at agricultural farm, orchards and wetlands care for survival of birds with suitable eco- bio-management is

desirable with consultancy of expert ecologist that may help in conservation of vanishing birds.

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BIRD HAZARD TO AIRCRAFT IN INDIA

ROBERT B. GRUBH

ABSTRACT[1]

At a request from the Indian Air Force and the Ministry of Defense (AR & DB), the BNHS made on ecological study of bird strike hazard at 22 aerodromes in India. The study commenced in 1980 and ended in 1988. The aerodromes covered included all the four international airports as well as many other civil and defense aerodromes from north to south and east to west, covering different geographic conditions.

The study indicated that vultures (Accipitridae) and the Pariah Kite *Milvus migrans* were the major potential problem birds for aircraft during flight phases outside the aerodrome. Within the aerodrome the problem birds included Pariah Kite. Blue Rock Pigeon *Columba livia* and several other species.

The major causes for proliferation of potential problem birds within the aerodrome are attractive habitat conditions such as uneven terrain with temporary or perennial water bodies, various types of vegetation providing food and shelter and pigeon-attracting hangars. Availability of non-vegetarian garbage within or in the immediate vicinity of the aerodrome too is an important factor causing the presence of Pariah Kite within the aerodrome.

Bird hazard problem within the aerodrome can be effectively controlled by carrying out the following measures.

1. Removing all trees and other vegetation from within the aerodrome.
2. Leveling and grading as well as instituting proper drainage system.
3. Periodic grass-cutting operations to keep the height of grass within 20cms.
4. Pigeon-proofing all hangars and other buildings within as well as in the close vicinity of the aerodrome.
5. Strict control over non-vegetarian garbage disposal within and in the immediate vicinity of the aerodrome.

The major causes for proliferation of potential problem birds such as vultures and pariah kite in the flight path of aircraft outside the aerodrome are availability of livestock carcasses around towns and cities, primitive slaughter-houses, and primitive garbage disposal.

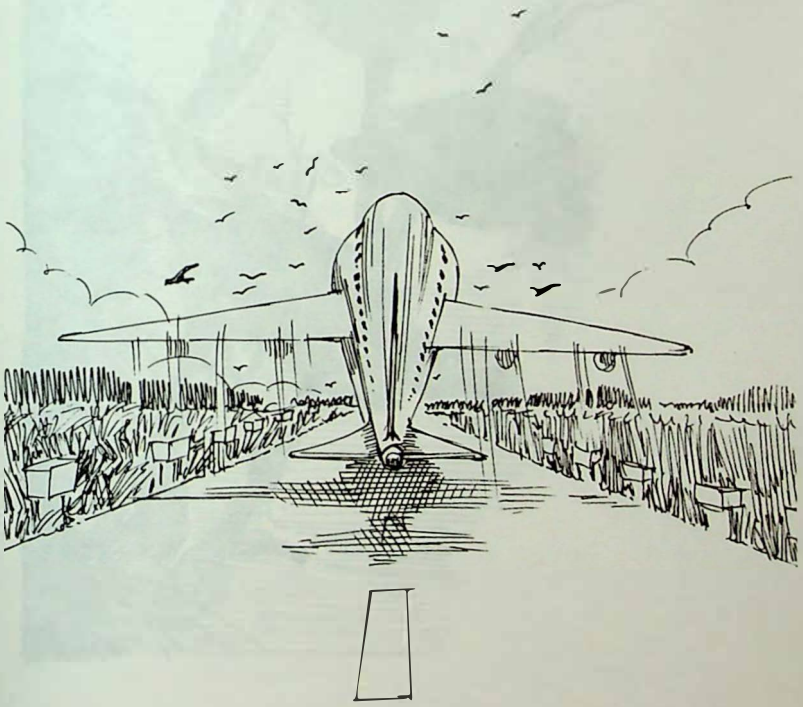
Bird hazard problem outside the aerodrome can be effectively controlled by carrying out the following measures:

1. Setting up of modern carcass and non-vegetarian garbage processing plants.
2. Replacing the primitive slaughter houses with modern abattoirs.

As a part of the bird hazard prevention programme outlined above it is also essential to continually monitor bird strike incidents occurring at various aerodromes throughout the year. In this regard the pilots and aviation authorities have an important role to play. An immediate responsibility in this area is to report every bird-strike incident in the prescribed format along with bird remnants to the BNHS for further study.

Address for correspondence:
Not available.

[1] Paper not received till the time of printing.



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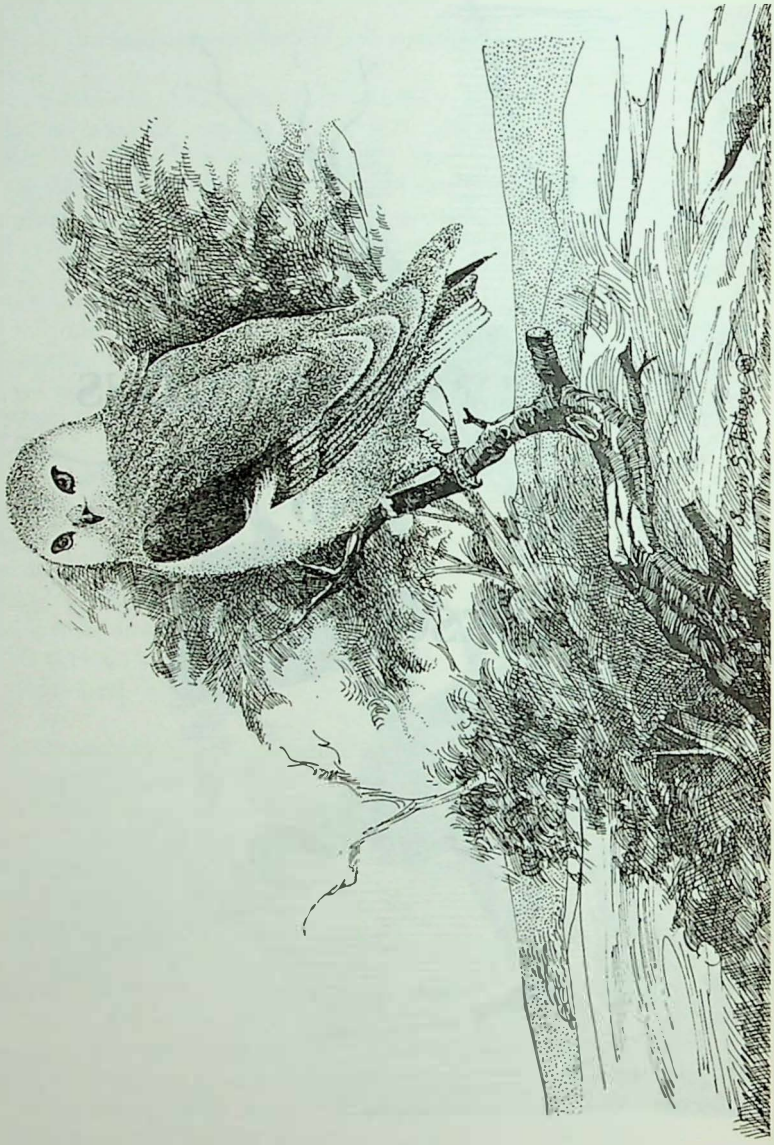


The National Seminar of the Birdwatchers' Society of Andhra Pradesh, held at Hyderabad (India) on 7th and 8th February 1990, was attended by participants from various states of the country representing state governments, colleges, universities and non-governmental organizations.

The Seminar Committee records its appreciation of the help and co-operation of the Andhra Pradesh State Forest Department and its various officers in holding of this Seminar in Hyderabad.

It also records its gratitude to the efforts of all those people who contributed to the success of the event in so many different ways.

RESOLUTIONS CONCERNING BIRDS AND THEIR ECOSYSTEMS

1. Considering the need for co-operation among bird-watching groups in environmental issues;

   It is **RESOLVED** to invite bird-watchers, bird-watching groups and other nature societies, initially from south India, to form a federation.

   Proposed: D.L.N. Rao. Seconded: B.C. Choudhury.

2. Considering the fact that this Seminar has been a very successful event;

   It is **RESOLVED** that Birdwatchers' Society of Andhra Pradesh will take a lead to convene a annual / bi-annual regional congress to be termed as the Andhra Pradesh Bird Congress, to promote the growth of Ornithology in the state. This Congress should be convened in different cities and towns of the state to help promote local birding groups.

   Proposed: P. Balu. Seconded: V.J. Rajan.

3. The Seminar **RESOLVED** that the Government and other Departments be asked to develop programs for farmers to explain the beneficial role of birds.

   It is also **RESOLVED** that organizations like Indian Agricultural Research Institute develop harmless insect repellant measures like reflecting tapes, nylon-nets, *etc.*, to keep away birds from crops.

   Proposed: Dr. P. Shyamsunder. Seconded: Dr. S. Tej Kumar.

4. It was recommended that persons displaced during developmental work, especially women, be employed in conservation work as they are the most affected;

   RESOLVED that steps be taken to impress upon the Government to involve local people who are most affected by development in conservation programmes.

   Proposed: Rabia Hasan. Seconded: Mrs. G.R. Plumber.

5. Considering the fact that village tanks play an important or crucial role for wintering waterfowl, special protection status may be recommended for such water-bodies.

   RESOLVED that a proposal be submitted to the State Government or the appropriate authority recommending a special protection status for village tanks and other such water-bodies.

   Proposed: B. C. Choudhury. Seconded: V. Vijay Kumar.

6. **RESOLVED** that Doordarshan be requested to allot a time-slot for transmission of conservation programmes. The Birdwatchers' Society of Andhra Pradesh could make a beginning with programmes on various sanctuaries of Andhra Pradesh and important wetland areas.

   Proposed: Mrs. G.R. Plumber. Seconded: P. Balu.

7. **RESOLVED** the State Forest Department is requested to develop a scheme for assistance to NGOs for awareness programmes of specific projects.

8. Also recommended that efforts should be made to inculcate interest in wildlife and conservation work among media persons. Involve newspapers and magazines in spreading the message of wildlife conservation and institute awards for lesser-known individuals of organizations for significant conservation work.

   It is hereby **RESOLVED** that steps be taken to educate and involve press persons and the newspaper media in the spread of conservation / wildlife message.

Further **RESOLVED** that table awards be instituted for lesser known conservation workers or N.G.O's.

Proposed: P. Balu.

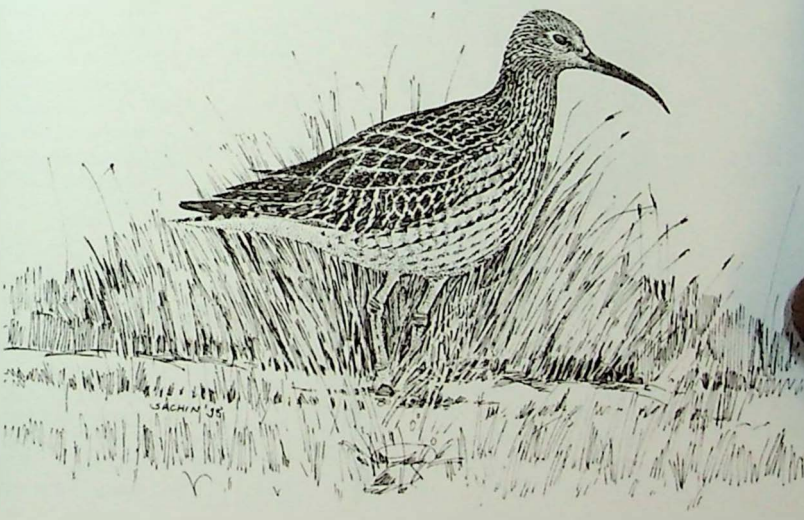
9. **RESOLVED** that steps may be taken to enthuse engineers and other technical persons in their responsibility and role in environmental problems.

Proposed: G.V. Ramanan.

10. It was recommended that considering the importance of Singur Reservoir as a Wetland Refuge, it may be clubbed with the Manjira Wildlife Sanctuary and formed into a Greater Manjira-Singur Wetlands Sanctuary.

RESOLVED that the Government of Andhra Pradesh be requested through the A.P. State Forest Department (Wildlife) to take measures to form a Greater Manjira-Singur Wetland Sanctuary.

Proposed: B.C. Choudhury.



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Our Logo: Indian Pitta *Pitta brachyura*

The word PITTA has come into ornithology from the Telugu *pitta*, [small bird, (in the native tongue of Andhra Pradesh state)], latinized by Vieillot in 1816, as the name of a Genus, and since adopted by English ornithologists as the general name for a group of birds, remarkable for their great beauty. In ornithology, the word is first found as part of the native name *ponmunky pitta* given in 1713 by Petiver, in the "mantissa" to John Ray's SYNOPSIS, on the authority of one Edward Buckley of Fort St. George, Madras city. This bird is the *Pitta bengalensis* (now *P. brachyura*) of modern ornithologists.

[*Encyclopaedia Britannica*, 11th edition, 1911]